


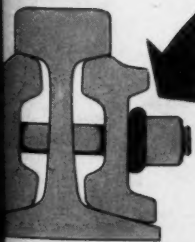
FEBRUARY, 1940

Railway Engineering and Maintenance

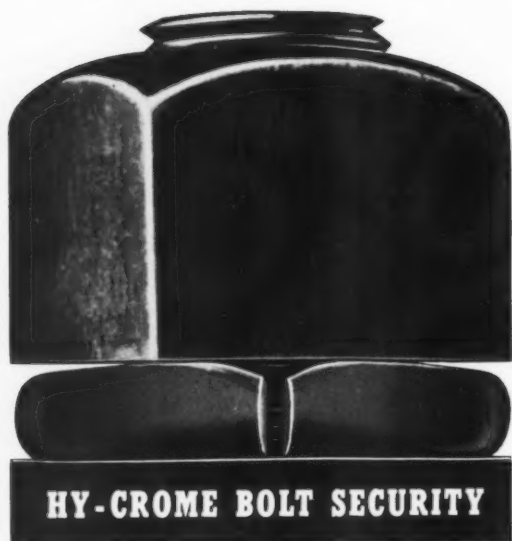
**IMPROVED HIPOWER
SPRING WASHERS**



CUSHION
THE TREMENDOUS
SHOCKS IMPARTED TO
TRACK BOLTS BY THE
POUND - POUND - POUND
OF
HEAVY
ROLLING
LOADS



Reliance HY-CROME Spring Washers



*Adequate
Tension*

MEANS A TIGHT BOLT

- **OVERSTRESSING OF BOLTED PARTS** in wrenching a nut down can create a bad fastening condition. Use of the proper type **RELIANCE HY-CROME SPRING WASHER** will help avoid this.
- **ADEQUATE TENSION** over a sufficient reactive range, to anticipate normal wear and looseness, can be secured from a non-fatiguing **RELIANCE HY-CROME SPRING WASHER**, made to your specific requirements.
- **KEEPING A BOLT TIGHT** requires an effective compensating device, which, from time of installation through a service period, automatically anticipates the development of normal wear and looseness, while maintaining the proper reactive tension. **RELIANCE HY-CROME SPRING WASHERS** meet this requirement.
- **YEARS OF RAILROAD USAGE** has established the dependability of **RELIANCE HY-CROME SPRING WASHERS** to efficiently meet service demands — a type for every specific application.

EATON MANUFACTURING COMPANY

RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

Sales Offices: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Illinois. Subscription price: United States and Possessions, and Canada, \$2.00; Foreign, \$3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

LEVEL THE LITTLE HILLS OF LOW JOINTS



Bethlehem Track Fastenings hold the rails to rigid, accurate alignment. They eliminate the little hills less efficient fastenings make at the end of each rail. They keep the rail joint assembly tight.

The strength and tenacity of Bethlehem Heat Treated Bolts and Hot Forged Nuts fit them for the hardest rail joint service. They keep end batter and low joints at the minimum. They materially reduce maintenance costs.

*We are licensed to manufacture
Dardelet thread track bolts.*

BETHLEHEM STEEL COMPANY



for **TENSION
+ REACTIVE
SPRING PRESSURE
AFTER JOINT WEAR**
TRIFLEX



**VERONA FIXED
TENSION TRIFLEX SPRING**

Assures— 1—Adequate Bolt Tension
2—Reactive Spring Pressure
More than 2 times
A.R.E.A. Requirements

Booths No. 177-178
National Railway
Appliances Exhibit
International Amphitheatre
Chicago—Mar. 11 to 14



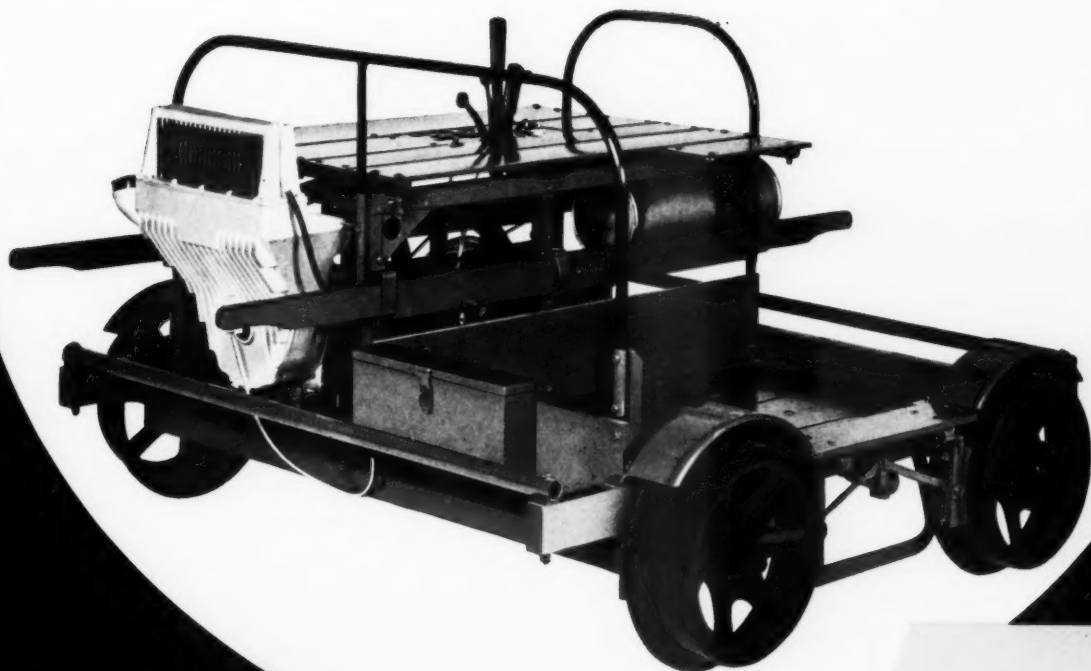
SINCE 1873

WOODINGS-VERONA
TOOL WORKS VERONA, PA.



SINCE 1873

FAIRMONT LEADS IN FEATURES THAT SERVE YOU BEST



FOR
*Emergency Work
or Routine Inspections*

Fairmont

59 SERIES "D" CAR

The deep, extra wide tray of this light oak frame inspection car holds a surprising number of tools, drills and other heavy or bulky supplies for emergency repairs. And for routine inspection service by one or two men, the Fairmont 59 Series "D" Car provides comfortable, economical transportation with utmost safety. Guard rails front and rear, wheel guards, four wheel brakes, rail skids, and extension lift handles combine to make this model one of the safest and easiest riding cars ever designed. Ask for Bulletin 389. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

*Preferability
of the Top
Country*

EXTRA WIDE
TOOL TRAY

LONG-LIFE 5-8 H.P.
ROLLER BEARING
ENGINE

WATER-COOLED

EXTENSION
LIFT HANDLES

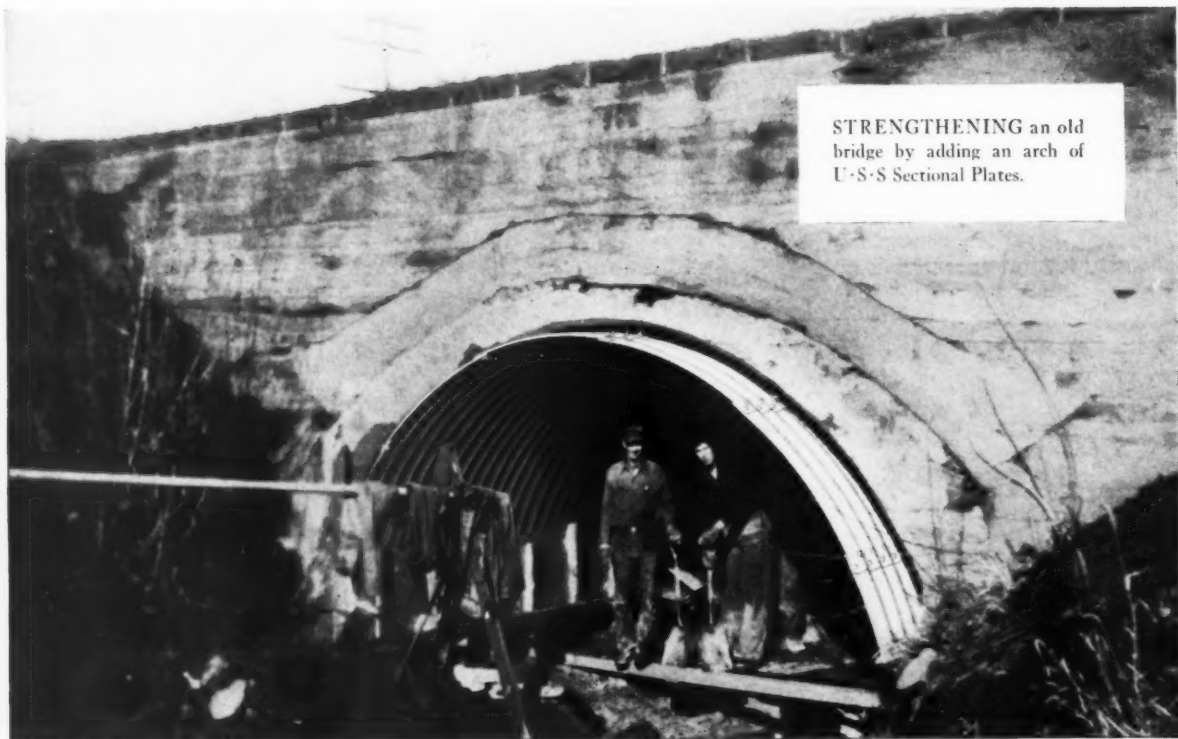
STURDY OAK FRAME

OF ALL THE CARS IN SERVICE TODAY

More Than Half are Fairmonts

"Old-age Security"

FOR SMALL BRIDGES



STRENGTHENING an old bridge by adding an arch of U·S·S Sectional Plates.

U·S·S Sectional Plates add new strength and rigidity

THEY put new life into this old bridge when they gave it a backbone of U·S·S Steel Sectional Plates. Constant pounding of heavy traffic had weakened the structure until it was necessary to replace the bridge or do a first-class repair job.

A U·S·S Steel Sectional Arch solved the problem. It was easily

bolted into place under the old arch and the intervening space pumped full of concrete. Now the bridge has the necessary strength and resistance to vibration to assure many more years of useful life. The cost was small compared to that of a new bridge.

U·S·S Sectional Plates have many advantages. They simplify construc-

tion of new bridges, are easy to put together with ordinary labor, last a lifetime, decrease construction costs. The base metal is durable U·S·S Copper Steel with a heavy coating of galvanizing for added protection against corrosion. Sectional plates made from pure iron can also be supplied.

Highly satisfactory results have been obtained with U·S·S Sectional Plates for culverts, safety underpasses, for enclosing small streams and similar uses. Investigate this new way to reduce maintenance.



SECTIONAL PLATES

CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh and Chicago

COLUMBIA STEEL COMPANY, San Francisco

TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham

Scully Steel Products Company, Chicago, Warehouse Distributors

United States Steel Export Company, New York

Look for this trade-mark on steel products. It is your assurance of quality and full value for your money.

UNITED STATES STEEL

Now is the Time **KEEP UP THE TRACK WITH I-R AIR TOOLS**



WITH the approach of milder weather, there is no time like the present for you to start planning the repair of the damage done to your track during the winter. Surfacing is accomplished rapidly and economically with I-R Air Tools. I-R Crawl-Air Compressors and the handy Spot Tamper Compressor can be easily moved from point to point as necessity requires.

The MT-3 Tie Tamper is the logical tool to accompany these compressors. Its extremely low air consumption is noteworthy, and you get more work for the amount of air or fuel formerly consumed.

A handy tool for digging out the cribs between ties when skeletonizing track is the MT-1, 2 or 3 tie tamper equipped with a cribbing fork. This specially constructed tool has proved very successful on many leading roads.



Ingersoll-Rand

853-11

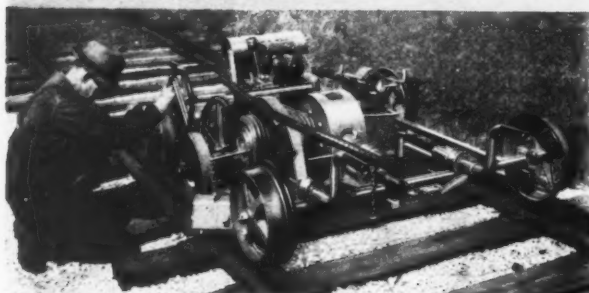
11 BROADWAY, NEW YORK CITY

Do All Your Grinding With NORDBERG GRINDERS

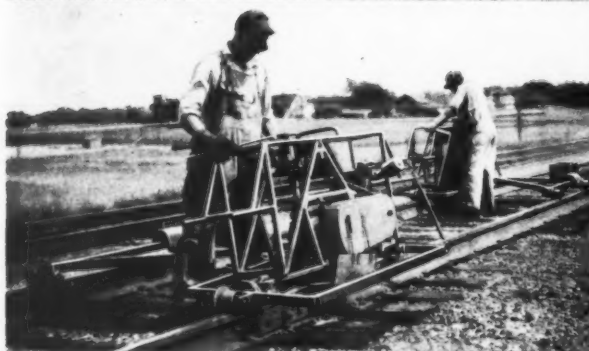
**A type for every job
Better Quality of work
Less time - Lower costs**



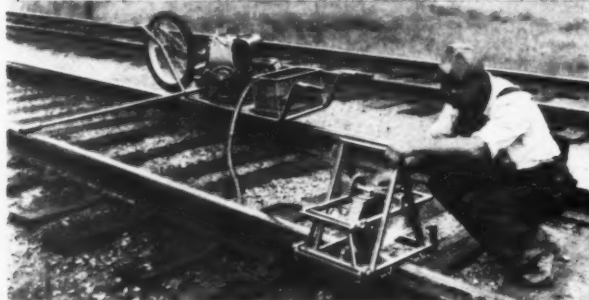
TYPE BG HEAVY DUTY SURFACE GRINDER
For faster progress and lower cost grinding of welded rail ends.



TYPE DG LIGHT WEIGHT SURFACE GRINDER
Especially suited for grinding welded rail in heavy traffic areas, yards and terminals.



TYPE CG PRECISION CUP WHEEL GRINDER
For extreme accuracy in grinding welded joints, removing mill tolerance, equalizing height of cropped rail, etc.



TYPE TG UTILITY GRINDER
For slotting rail ends, switchpoints, frog and crossing maintenance and other rail grinding jobs.

This line of Nordberg Grinders was developed to permit of greater speed, accuracy of work, adaptability and lower cost in doing the many grinding jobs encountered in the maintenance of track. While each machine was designed for a specific application, all are adaptable to other grinding jobs by use of the various Nordberg Accessories which have been developed for them. The uses to which these machines may be put include grinding of welded rail, removing mill tolerance, equalizing the height of cropped rail, removing the hump at hardened rail ends, taking off flow from stock rails and switchpoints, slotting rail ends and grinding frogs and crossing flangeways. Where there is grinding to be done on track, there is a Nordberg Tool best suited for the job.

NORDBERG POWER TOOLS FOR MAINTENANCE WORK

Surface Grinder
Utility Grinder
Spike Puller
Power Jack

Precision Grinder
Adzing Machine
Track Wrench
Rail Drill

Track Shifter

NORDBERG MFG. CO.
MILWAUKEE, WISCONSIN

Export Representative

WONHAM, Inc., 44 Whitehall Street, New York City

Building-up Frogs

ANOTHER ECONOMICAL OXWELD DEVELOPMENT

• The service life of open-hearth frogs is increased by building-up worn points and wing rails by oxy-acetylene welding, using Oxweld MW welding rod. The work is most economically done in track, but can also be performed out of track where heavy traffic conditions make this necessary. Railroad welding operators are trained by Oxweld to perform this work so that a minimum of forming and grinding is necessary.



THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation



Carbide and Carbon Building Chicago and New York



Service and Materials for all Standard Oxy-Acetylene Welding and Cutting Operations plus . . . Pressure Rail Welding . . . Shape-Cutting . . . Stack-Cutting . . . Hard-Facing . . . Flame-Cleaning . . . Flame-Hardening . . . Wrinkle-Bending . . . and Unionmelt Welding.



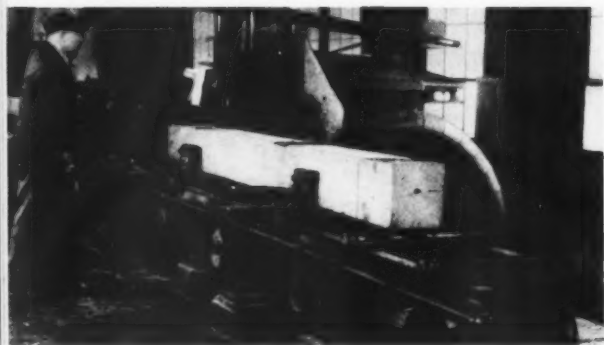
SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

The words "Oxweld" and "Unionmelt" and the designation "MW" are registered trade-marks of Units of Union Carbide and Carbon Corporation.
Railway Engineering and Maintenance

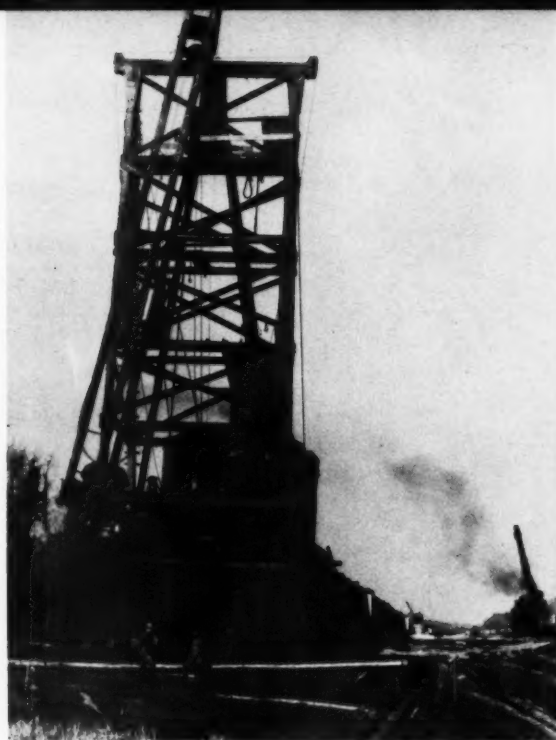
February, 1940

67

For Timber Bridges
... use **PRESSURE-
CREOSOTED TIMBER.**



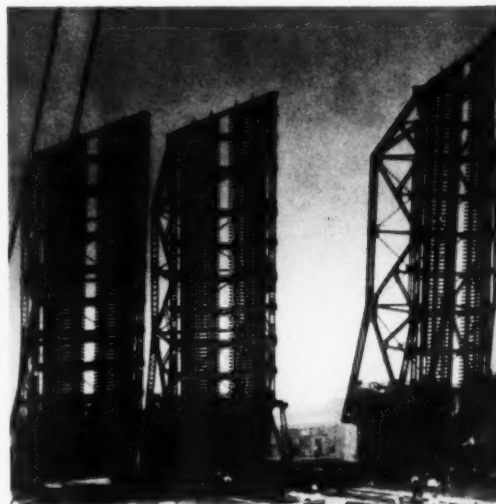
ALL THE TIMBER for a bridge can be preframed before it is pressure-creosoted, so that there is no cutting in the field and no exposure of untreated material. Plans for preframing timber bridges are made as carefully as for steel structures.



THE EDITOR of a railroad magazine recently estimated that there are 13,000,000 linear feet of timber bridges in service on American railroads, and that "the savings that can be effected through the universal use of treated timber for trestles, including both replacement and maintenance costs, exceeds \$20,000,000 a year."

"EVEN WITH THE BEST material available," writes the railroad editor, "the life of an untreated timber trestle ranges from 4 to 20 years, depending on its location, with the average for the country as a whole about 8 years. In contrast, the life of creosoted trestles may be conservatively estimated at 25 years."

WRITE TO The Wood Preserving Corporation for further information on the long life and economies of pressure-creosoted timber for railroad bridges and other structures.



Other Koppers Products: Coal . . . Coke . . . Coal Cleaning and Handling Systems . . . General Engineering and Construction . . . Roofing . . . Waterproofing . . . Cylinder Packing . . . American Hammered Piston Rings . . . D-H-S Bronze . . . Tar Base Paints . . . Weed Killers . . . Car Floats, Ferries . . . Tarmac Paving . . . Disinfectants, Insecticides.

ONE OF THE PRINCIPAL SUPPLIERS OF PRESSURE-TREATED TIMBER TO THE RAILROADS:

THE WOOD PRESERVING CORPORATION • PITTSBURGH, PA.

a **K O P P E R S** *subsidiary*

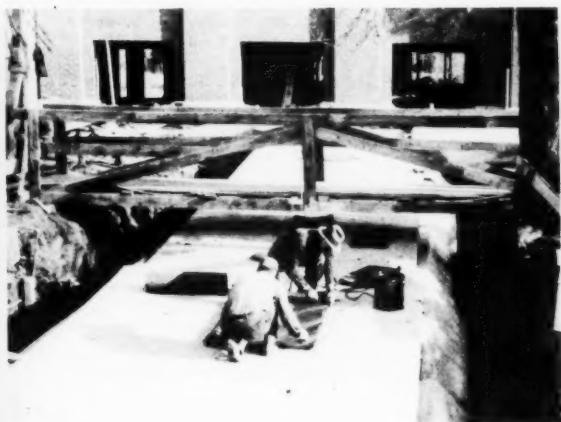


WATER SEEPING through the decks of railroad bridges often drips on pedestrians and motorists passing below. Some of this water, freezing in winter, causes spalling of concrete.

The safest way to prevent both these troubles is with Koppers Membrane Waterproofing.

Koppers Membrane Waterproofing is constructed in place by mopping plies of Koppers Tar-Saturated Fabric or Koppers Tar-Saturated Felt with Koppers Waterproofing Pitch. A strong, elastic continuous waterproofing blanket is built up to protect the concrete or masonry from water.

Photograph shows Koppers Waterproofing being applied on the deck of a bridge on the Pittsburgh and West Virginia Railroad at Broughton, Pa.



RAILROAD UNDERPASSES and tunnels are also protected from the action of ground water with Koppers Membrane Waterproofing, which prevents leaks and damage to the concrete. Photograph shows an underpass on the Pennsylvania Railroad at Ford City, Pa., which was waterproofed with Koppers Waterproofing.

For Concrete and
Steel Bridges
... Use
KOPPERS
WATERPROOFING



WHEN THE CONCRETE has been poured for the bottom of the underpass or tunnel, the waterproofing is applied on the concrete and run out to the edges. Then the concrete is poured for the sides and top and the waterproofing envelope is run up the sides and over the top, enclosing the entire structure in a water-tight envelope.

*Send for further details about waterproofing
railroad structures.*

KOPPERS COMPANY • PITTSBURGH, PA.

TO RAILWAY SUPPLY MANUFACTURERS

"At the N.R.A.A."

"Boss, we're going to exhibit our equipment at the railway show next month, aren't we?"

"What show?"

"The National Railway Appliances Association's show at the International Amphitheatre in Chicago on March 11-14."

"Oh, that show. I've given no thought to it. Of what value is it to us? Everybody knows about *our* equipment. And what's more, those engineers don't visit the show anyway. Why, they tell me that they start their meetings at 9 o'clock in the morning and stay at it until 5 o'clock at night."

"That's right, boss—and they sometimes hold night sessions too. They're the hardest working bunch I know of. But they're just as serious in studying the exhibit, to be sure they're not overlooking anything that'll help them."

"But how do they, if they're attending the meetings all the time?"

"It's this way, Boss. In the first place, the convention closes at four o'clock on Tuesday afternoon so that all of them can spend that evening at the show. It's kept open purposely for them that night and it's packed. And they steal away from the convention from time to time when reports are being considered that they're not specially interested in. The program is built up with that in mind."

"But . . ."

"And don't forget, Boss, that the exhibitors run buses between the convention and the exhibit every 10 minutes to make it easy for these men to get to the show—and to save time. No, sir, those men visit the exhibit and they study it too."

"All of which means that you think we should exhibit."

"We can't afford not to. Our customers will be there—and so will our competitors."

"All right, we'll apply for space. Whom do we see?"

"Write Charley White, secretary of the N.R.A.A. at 208 S. LaSalle street, Chicago. He'll send you all the papers."

"I'll do it."

"And, Boss, let's make a complete job of this exhibit by placing an 'ad' in the March issue of *Railway Engineering and Maintenance*. That magazine is the bible of railway maintenance officers."

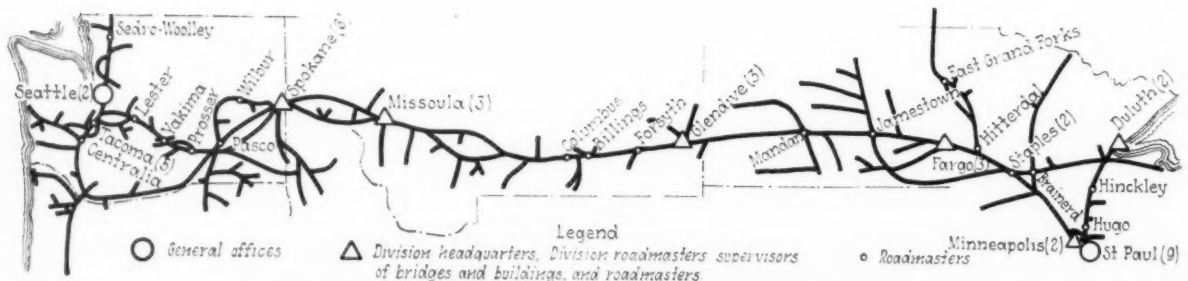
"Why that issue?"

"That's the equipment economies issue, which is given over to featuring work equipment like ours—showing how it reduces costs and increases output—how to use it to the best advantage, etc. These articles are brass tuck articles written by men who know what they are talking about. And they bring the readers—and don't forget, Boss, that they're our customers—into a frame of mind to appreciate work equipment, at the very time when they're working on their programs for the year—and thinking about equipment. Boss, that issue's a 'natural' for us."

"It does sound interesting."

"And don't forget that this issue reaches these railway men just before they leave their homes for the convention. If we advertise our equipment in that issue, they'll all look us up to learn more about it. And don't forget, too, that this 'ad' reaches the men who can't get away to attend the convention."

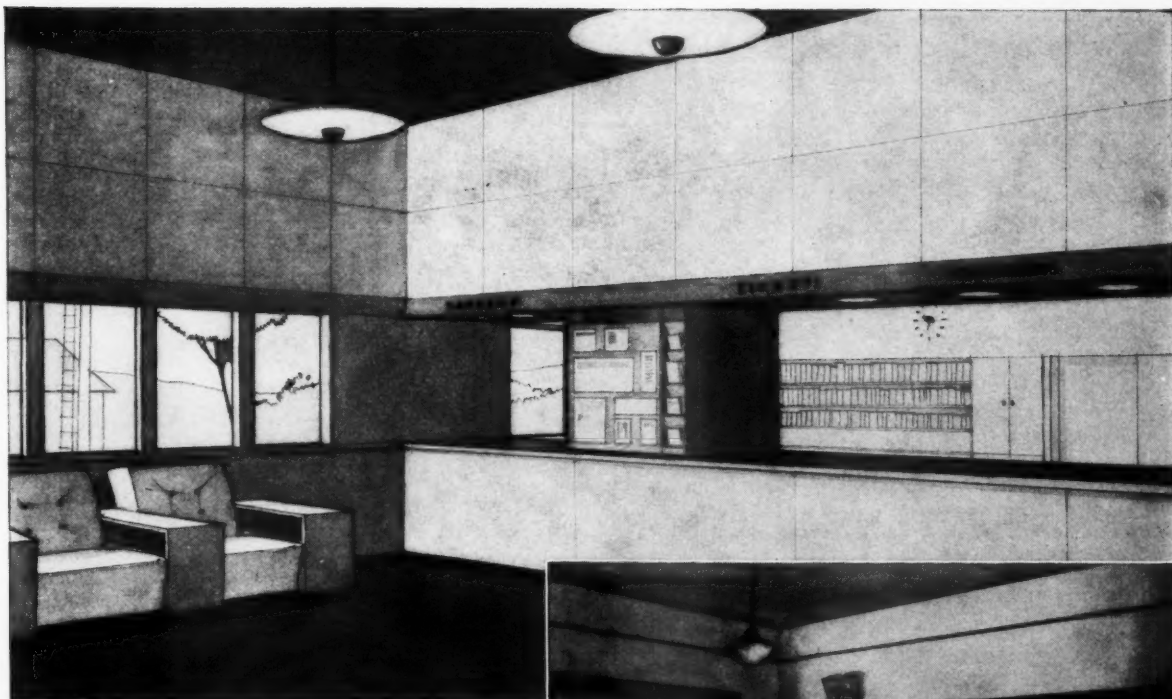
"All right, Bill. We'll arrange for space and advertising too—to cash in on the bigger business that's in the making for 1940."



Railway Engineering and Maintenance Goes Every Month to 54 Maintenance Supervisory Officers of the Northern Pacific at 2 General, 6 Division and 19 Other Supervisory Headquarters, Scattered All the Way from Duluth, Minn., to Seattle, Wash. This Magazine Goes Also to 13 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on This Railway.

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

Would you believe that this smart, puncture-proof interior . . .



**... once looked
like this?**



MODERNIZE WITH VERSATILE DOUGLAS FIR PLYWOOD

● In streamlining your trains have you forgotten about your stations? Do they offer your passengers the same comfort and convenience as your smart new trains? They should . . . and can . . . if you modernize them with versatile Douglas Fir Plywood.

Douglas Fir Plywood wallboard (Plywall) is ideal for covering cracked, dingy plaster. It provides a puncture-proof wall surface . . . one that can be attractively paneled and given any one of many beautiful modern finishes. (Write for folder containing finish-

ing specifications.) EXT-DFPA, the weather-proof grade of Plywood, will spruce up any exterior as well as make it wind-proof, dust-proof and far stronger. And for general utility work, Plyscord sheathing is unsurpassed. It makes walls 5.9 times as rigid as horizontal board sheathing.

Investigate all the advantages of modernizing with this engineered lumber. Write for specific recommendations or literature today. Douglas Fir Plywood Association, Tacoma Building, Tacoma, Washington.

● "Face lifting" is a cinch when you use Plywall, the wallboard grade of Douglas Fir Plywood. The big 4' x 8' panels work easily with all tools, take any finish and are easy to keep clean. Best of all, they're puncture-proof. Even a mule can't kick through a plywood wall!



**SPECIFY DOUGLAS FIR PLYWOOD
BY THESE "GRADE TRADE-MARKS"**

PLYPANEL D.F.P.A.

EXT.-D.F.P.A.



Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Subscribers and Readers

Dear Reader:

February 1, 1940

"How many subscribers do you have?" I am frequently asked. "Do you mean subscribers or readers?" I always reply—for there is a difference in the totals. This was demonstrated interestingly in a letter that came to my attention within the last week.

Noting that a roadmaster on a prominent western railway was receiving three copies of Railway Engineering and Maintenance, we wrote him to ascertain what use he was making of these additional copies. His reply is illuminating.

In it he advises that these copies are circulated among his foremen. "You will note," he writes, "that the number of foremen on my district makes it necessary that these three copies go a long way. The foremen are eager to get them. After reading, they forward the magazine to other foremen until all have read it. After each man reads his copy, he advises me that he has forwarded it to the next foreman in the order instructed. After the copies have been read by all of the men, they are returned to my office for file.

"I am doing this," he adds, "because I have found in my 21 years' experience in engineering and maintenance work that Railway Engineering and Maintenance is essential for one's training in railway work. I am convinced that every maintenance man can gain in knowledge by reading this magazine from cover to cover."

This attitude and this action are by no means unusual. On the contrary, they are duplicated among thousands of our subscribers in general and division offices as well as out on the line, with the result that our readership is not measured by our 7,000 subscribers but by at least three and probably five times that number of interested railway readers.

Yours sincerely,

Elmer J. Howson

ETH:EW

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

1940 BUDGETS

Should Include

SPACE 15
N. R. A. A.
EXHIBIT
MARCH, 11-14-1940

BARCO

Type K-1 Light Weight
Tytamper for all types
of ballast and general
tamping.



BARCO UNIT TYTAMPERS

Lower Initial Capital Expense for Equipment.

Lower Operating Cost.

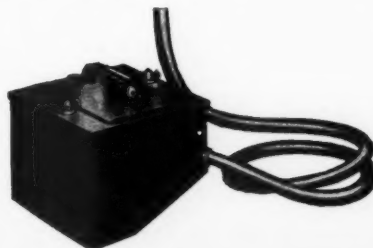
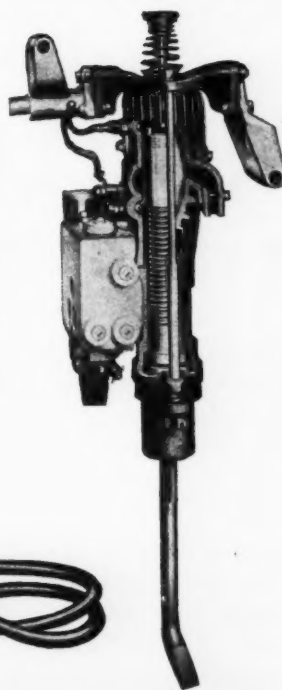
All Year Around Service in Gangs or in Individual Units.

Entirely Self-Contained—Carried by One Man—No Auxiliary Equipment Required.

BARCO provides the Most Flexible, Convenient and Efficient Method of Maintaining Thoroughly Tamped Tracks, as Evidenced by Their Use on 53 Railroads.

BARCO

Type TT-2 Heavy Duty
Tytamper, for use
where a very heavy
blow is desired.



BARCO MANUFACTURING COMPANY

1805 W. Winnemac Ave.

In Canada

Chicago, Illinois

THE HOLDEN COMPANY, LTD.

Montreal

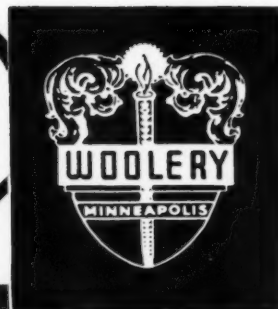
Moncton

Toronto

Winnipeg

Vancouver

WHY drag OUT THE WORK?



**YOU CAN CLEAN IT
UP WEEKS AHEAD**

With the
**WOOLERY
TIE CUTTER**



Speed up your tie renewals with this simple, efficient machine. The *Woolery Tie Cutter* cuts the tie in three easily handled pieces that are quickly removed by one man.

The *Woolery Tie Cutter* also eliminates the necessity for digging out the ballast in the crib—avoids disturbance

of the compacted bed on which the old tie rested—and makes retamping unnecessary. You can save twelve cents or more on every tie removed. This light-weight machine can be removed from the track by the operator in ten seconds.

These labor and time-saving features of the *Woolery Method* make it possible for you to cut your tie renewal

costs 30% and so speed up the work that your renewal program can be completed weeks, or even months, ahead of schedule.

We have prepared a 12 page booklet giving full details on the *Woolery Method of Tie Removal*. May we send you a copy? Write today—Arrange for a demonstration on your Road.

WOOLERY MACHINE COMPANY

MINNEAPOLIS

Pioneer Manufacturers of

MINNESOTA

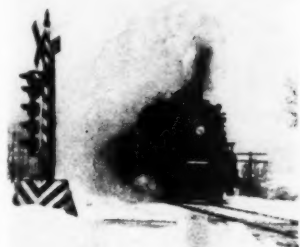
RAILWAY MAINTENANCE EQUIPMENT

TIE CUTTERS • SWITCH HEATERS • MOTOR CARS
RAILWAY WEED BURNERS • BOLT TIGHTENERS



Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE



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FEBRUARY, 1940

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ELMER T. HOWSON

Editor

NEAL D. HOWARD

Managing Editor

MERWIN H. DICK

Eastern Editor

GEORGE E. BOYD

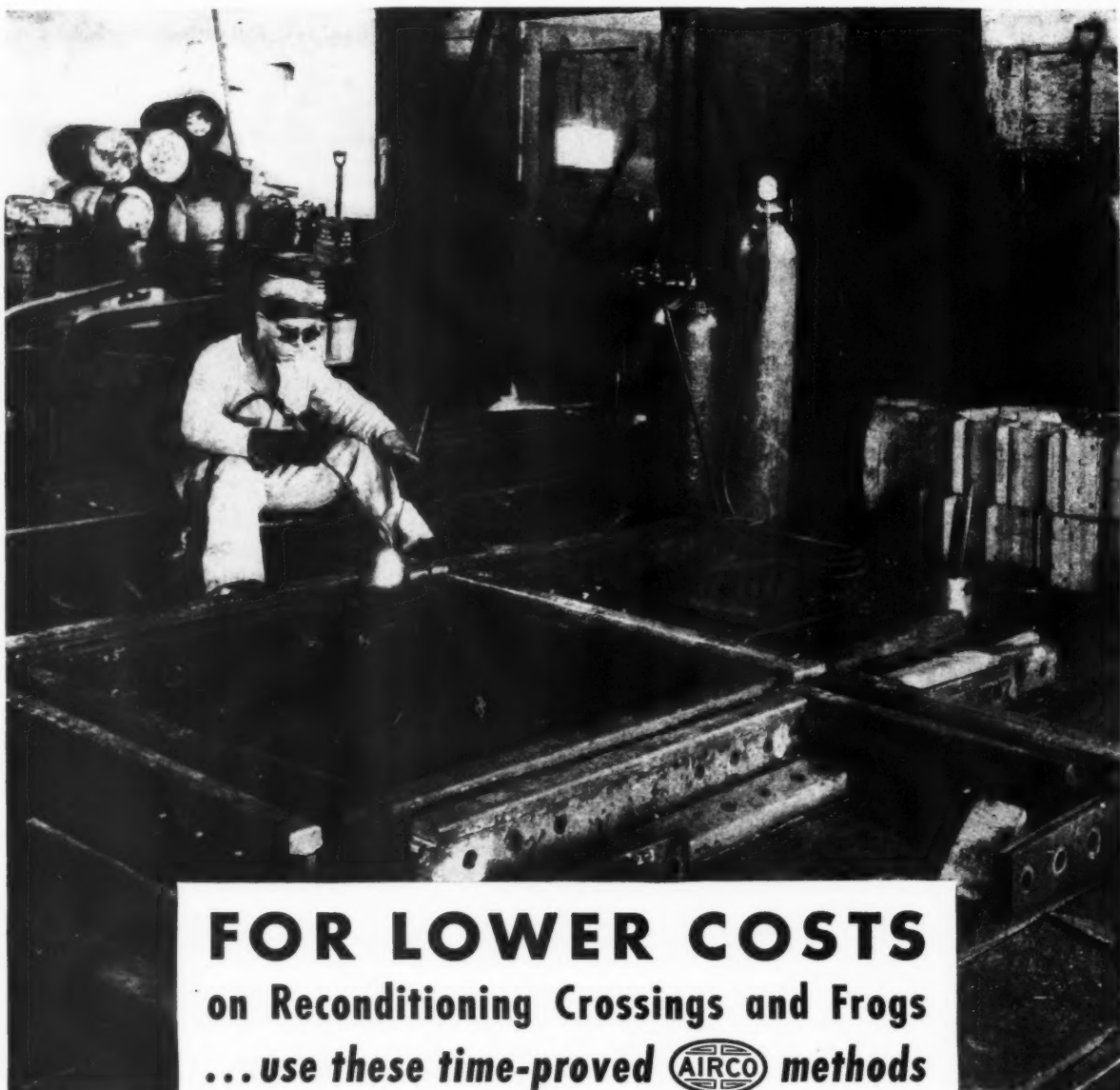
Associate Editor

JOHN S. VREELAND

Associate Editor

F. C. KOCH

Business Manager



FOR LOWER COSTS on Reconditioning Crossings and Frogs ...use these time-proved methods

Worn Frogs and battered rail ends are quickly reconditioned with the Airco Oxyacetylene Process — then heat-treated with the same torch for longer life. These operations may be done either in the shop as illustrated, or, on the road if desired. They are but two of the many ways in which the Airco Oxyacetylene Flame is cutting maintenance costs from

coast to coast. » » The practical experience and advice of the members of our Applied Engineering Department is at the service of Airco's railroad customers for problems such as rail end cropping, building up rail ends, hard surfacing, flame cutting locomotive and car parts, or in any other service in which Airco methods can be of assistance to you.

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Railway Engineering and Maintenance



Trucks

Are Monopolizing the Highways

IN December we published an editorial written by a United States senator, Hon. Clyde M. Reed—on the waterways. This month our lead editorial is written by a member of the President's cabinet, Secretary of the Interior Harold L. Ickes—on highway trucks.*

Mr. Ickes Speaks

"I doubt whether anyone will question the fact that the people started to build good roads so that they might have the pleasure and recreation that is made possible by traveling in their own cars at their own pleasure at reasonable rates of speed. At least this has been what we thought we were paying our road taxes for. But now we know better. We know now that we have been digging into our pockets to build boulevards for trucks.

"The lord of the highway is the truck driver. The monster which he drives at reckless speed regardless, generally speaking, of the rights of the mere motorist, each year seems to be growing longer and wider and higher. And if one truck isn't big enough to satisfy the road appetite of its owner, he can always attach a trailer. Thirty-five years ago we had rough roads; narrow roads that were alternately covered with dust or mud. But at any rate we had no trucks.

"I have promised some day to give myself the pleasure of driving down a truck-infested road in the biggest armored tank that I can find and bumping these pests from the road, regardless of where they may light. I wonder if anyone here would like to join me on that joyous occasion.

"As a motorist ventures forth with his family to drive a few miles on a pleasant Sunday afternoon he not infrequently finds himself in a situation that Tennyson might have described in this fashion:

Trucks in the front of him;
Trucks in the rear of him;
Trucks on each side of him;
Back-fired and lumbered."

"While the state of mind of the motorist, thus beset, might be written thus:

His not to reason why,
His but to pass and die.
Into the mouth of death,
Into the fumes of Shell,
Rode the encumbered.

"Although I do not enjoy it, I have learned to endure the gallantry of the truck driver who takes more than his fair share of the road; who passes you at streamliner train pace; who cuts in at headlong speed; who stops suddenly; who carries to your nostrils carbon-monoxide fumes from his exhaust, safe in the knowledge that, so far as he is concerned, every motorist travels at his own peril. But what particularly annoys me on a holiday or week-end trip is to see emerge out of the distance a leviathan that has just had a litter of motor cars that it is transporting from the lying-in factory."

Mr. Ickes Is Not Alone

And Mr. Ickes is not alone in his antagonism to truck monopolization of the highways. On the contrary, the public at large is becoming increasingly hostile. This is demonstrated by a survey made by the American Institute of Public Opinion, following Mr. Ickes' attack quoted above. In this survey the Institute asked a representative cross section of men and women throughout the country, "Do you think freight trucks should be kept off the highways during certain hours on Sundays and holidays?" In reply, 67 per cent favored the banning of trucks, as compared with 33 per cent opposed to the suggestion—a vote of 2 to 1 in favor of giving the highways back to the private motorist during the periods of their greatest use. Analysis of this vote showed a marked uniformity between groups—between rural and city people and, for illustration, between various age groups, as follows:

	Yes	No
Under 30 years of age.....	66%	34%
Aged 30 to 49.....	65%	35%
Fifty and over.....	72%	28%

The arrogance of the truckers who have taken over for private profit a facility built by the public at large expense for its enjoyment and use is rapidly creating a storm of resentment that will go far to curb their operations. Not only are they usurping public property without paying adequate compensation therefor, but they are destroying the property itself long before the investment therein is amortized. When the public be-

*From an address before the American Automobile Association.

comes thoroughly awake to this destruction of its property, it will check it in no uncertain manner. This is a result which railway employees will welcome—and can help bring to realization.

Ice Jams

Preparation May Be Half the Battle

DESPITE the extended and widespread drought which affected the larger part of the country during the latter part of 1939, weather conditions since the first of the year have been such that maintenance officers should be on the lookout for ice trouble at their bridges when the late winter or early spring thaws set in. It may be argued that the drought has dried up some streams and so reduced the flow in others that the danger of ice jams has been eliminated for the season. Experience in other winters does not confirm this, however.

Obviously, if there is no flow in a stream there is no need to expect trouble from ice. On the other hand, any stream that has water in it will also have ice under long continued and severe cold, such as most of the country has experienced during January. Under these conditions small streams may be expected to contain more ice in relation to their flow than larger ones. In not a few instances, they freeze solid to their beds, after which the water must flow over the ice thus formed and builds it up until it becomes a real menace.

Relatively small openings are usually ample for the normal requirements of small streams, but they present a real obstacle to the passage of flood waters that are filled with ice. Deep snow now blankets wide areas, and if the break-up of winter should be accompanied by heavy rains, as so often happens after a severe winter, as much, if not more, trouble may be experienced at these small openings as at those over the larger streams. This trouble will be aggravated if the gradient of the stream bed above the railway is steep, for in this case the ice will be brought down in large volume and at high velocity, and will pack tightly wherever its onward course is retarded, as it will be at a restricted waterway opening through the roadbed.

If this has not already been done, it may be wise, even at this late season, to install several lines of ice breakers across the stream above the bridge. In any event, it becomes particularly important that the channel be cleared of snow for a considerable distance both above and below the bridge, and that for the same distance all accumulations of ice be blasted out and disposed of on the downstream side in such a way as not to obstruct the flow when the rise occurs.

It may also be desirable to have a supply of 40 or 60-per cent dynamite easily available to aid in breaking up any jam that may form. An important item in the

preparations for combatting ice jams that may endanger both roadbed and structures, is to have bridge gangs at or near the points where trouble is likely to occur. With an experienced foreman in charge, the formation of jams can often be prevented by guiding the ice through the opening by means of pike poles. If the men are not dispatched to the seat of the expected trouble before it occurs, there may be little that they can do before the water subsides and damage may occur despite their efforts. In any event, they will start under a severe handicap, for adequate preparation is half the battle.

Speed—

High Maximums or High Sustained

IT is with a source of pride and satisfaction that the railways of the United States, in particular, can point to the records of high speeds which have been attained by passenger trains in recent years. Speed is only one of the factors in which railway progress is evident, but in the present era of fast travel, it is one of the most important in the eyes of the traveling public, and has to be reckoned with. In fact, as regards speed, it is evident that the end is not yet in sight if the railways are to keep pace with the demands of the public, and are to minimize further inroads by air travel.

Unquestionably, the public has been amazed and intrigued by the maximum bursts of speeds which have been made by some of the newer trains of recent years, but it is safe to say that by far the large majority of rail travelers are more interested in the total elapsed time required for a specific journey than in high maximum speeds attained over limited territories enroute. What these travelers want is to get there quickly and comfortably.

There are two ways in which total elapsed travel time can be shortened—one, by high maximum speeds where attainable, and the other, by relatively high sustained speeds throughout. The former, and unquestionably the most spectacular, is admittedly possible, as has been demonstrated by repeated runs in which speeds of 110 to 120 m.p.h. have been attained for varying distances, but, without question, there is a growing feeling among railway men that the maintenance of a relatively high sustained speed to accomplish the end desired is much more feasible and economical from the standpoint of the railways, and more to be desired by the traveling public.

Reflecting this attitude, a railway executive officer recently pointed out the relatively small savings to be made in elapsed time through operating at a speed of 100 m.p.h. as compared with 90 m.p.h. He found that in the case of a certain Diesel-powered streamlined train, it required a distance of 32.4 miles to attain a speed of 97 m.p.h. on level track, with an elapsed time of 26 min. 22 sec. from the starting point to the end of the thirty-fourth mile. On the other hand, with a restricting speed of 90 m.p.h. maximum throughout the same distance, he found that there would be an elapsed time of 27 min. 13 sec.—indicating a saving in total running time of only 51 sec. for the higher speed in the thirty-four-mile run. Again, he pointed out that study of the possibilities of increasing



the maximum speed limit on a 112-mile district on his line from 90 m.p.h. to 100 m.p.h. showed that, even with the complete relocation of signals that would be required to permit operation at the higher speed, the saving in elapsed time over the 112-mile district at the higher speed would be only approximately 8 sec.

Maintenance of way officers are very much interested in this question of speed and they are directly concerned when it comes to providing a track structure suitable to carry high-speed traffic with safety and comfort. They are not concerned about their ability to provide a track structure suitable for any speed demanded, barring unreasonable limitations on expenditures for construction and maintenance, but they would be remiss in their duty if they did not point out to their managements, with all clarity, the effect of high speed, and especially excessively high speed, on the track, in the way of the added problems and increased costs that are bound to result.

Maintenance of way men have little concern about the effect on the track of power designed for the speeds at which it is to be operated, but, on the other hand, they have learned through costly experience to fear the destructive influence of locomotives operated at speeds appreciably in excess of those for which they were designed. In fact, this influence, mainly in the form of kinked rails and misalignment of the track, has recently been impressed so forcefully upon mechanical and maintenance of way officers alike, as the result of actual experience and field tests, that the problem of the "misfit" locomotive will be given increased attention in the future.

But entirely aside from the "misfit" locomotive, maintenance of way men know that high speeds have a very definite bearing upon the cost of track construction and maintenance. It has been demonstrated adequately that the higher speeds that have been attained to date demand no fundamental change in the present form of track construction, in the organization of maintenance of way forces, or in methods of maintenance, but, at the same time, it has been demonstrated with equal clarity, that high speeds do demand a sturdy track structure, a higher refinement in track maintenance, and an appreciable increase in the labor cost of maintaining this more refined track. Tests have shown that, depending upon the design of the equipment, the forces acting upon the track, both vertically and horizontally, increase materially with the higher speeds, varying from directly as the speed in some cases, to increases more nearly in proportion as the square of the speed. Regardless of design, it is evident that at the higher speeds, the effects of stops and speed restrictions, requiring longer deceleration and acceleration periods, increase the destructive forces on the track.

Furthermore, assuming ideally designed equipment for high speeds, tests have shown that with any irregularities in track surface, the shifting of the weight of the equipment from one rail to the other, and, therefore, the lateral forces on the rails, are more pronounced at the higher speeds. Also, it is a well known fact that the problems of superelevation and of greater refinement in line on curves are increased materially with the higher speeds, almost regardless of equipment design.

In view of these many and varied considerations the maintenance of way officer is very directly interested in any discussion of the relative merits of high maximum speeds as compared with relatively lower, high sustained speeds. Wherever this question arises, therefore, he

should be in a position to present a true picture of what is involved as regards the track and track maintenance, if he is to be of greatest service to his own road and to the railway industry generally.

Longer Ties

Should Be Given Increased Consideration

DURING the last decade of increasingly heavy axle loads, and in the more recent years of marked increases in speeds of both passenger and freight trains, maintenance of way men have given largely increased attention to the strength and stability of the track structure through the use of heavier rail and track fastenings, larger and heavier tie plates, increased size of ties, better ballast and a deeper ballast section. However, the question may well be raised whether longer crossties have been given the attention they warrant.

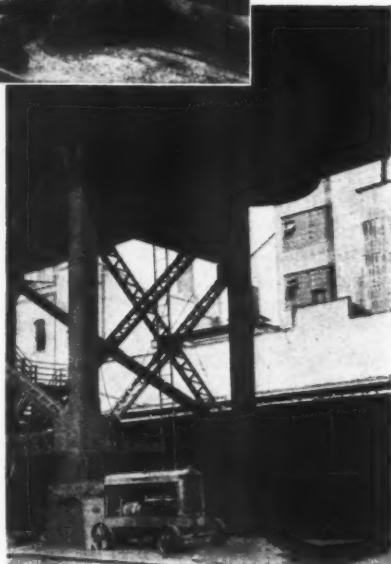
It is an elemental engineering principle that a load carried on a foundation which, in turn, rests upon a yielding support, should be centered upon that foundation in order to secure the greatest stability; yet this principle is violated in ordinary track construction, where the rail is not centered over that part of a tie which gives it support, unless an appreciable length through the center of the tie is left untamped. As a matter of fact, it is the practical acceptance of this principle that the load must be centered, that has resulted in the practice of tamping ties inside the rail only for a distance approximately equal to the length of tie outside the rail, except in highly yielding ballast, such as cinders. To do otherwise will cause center-bound track, with all of the disadvantages which this entails.

Complicating this situation still further is the fact, which is common knowledge among trackmen, that ties lack support for several inches from their ends, because, even when it is possible to tamp them solidly in this area, they do not remain tamped up solidly under the pounding and vibrating action of traffic. For this reason, ties of the lengths now in common use seldom afford equal bearing each side of the rail, no matter how carefully tamping is done. At the same time, it is being questioned seriously whether, as a whole, ties of present lengths afford sufficient bearing area to support the heavy loads of present-day, high-speed traffic. Obviously, as the length of tie is increased, the effective bearing area beneath each rail is increased and the load from each rail becomes more nearly centered over this area.

In view of these important considerations, attention is directed to an address by G. W. Harris, chief engineer of the Atchison, Topeka & Santa Fe, entitled, "What Can We Expect From Treated Ties?", which is reprinted in this issue, and especially to the statements therein relating to the adoption by his road of a 9-ft. tie for use in its principal main lines. While 9-ft. ties have been used in some places in the past to meet special roadbed conditions, this use has been extremely limited. Therefore, the adoption of this increased length by the Santa Fe for nearly 4,500 miles of heavy-duty main-line tracks is highly significant, and places this road in the position of leading the way in increased tie length, as it has for many years in the preservative treatment of ties.



Right — Two 300-Amp. Welding Generators Being Used for Bridge Strengthening Work—Above—Strengthening a Through Plate Girder



Strengthening To Meet

In this paper, which was presented at the convention of the American Railway Bridge and Building Association, October 17 to 19, 1939, Mr. Haggander discusses methods of strengthening various types of bridges and trestles to meet the requirements of modern traffic imposed by heavier live loads and high speeds, or to strengthen members weakened by the effects of corrosion or local deterioration, which may be caused by brine drippings, locomotive gases or other causes

THE strengthening of old bridges is occasioned usually by the necessity for imposing on them heavier live loads than those for which they were designed, or heavy loads at extremely high speeds. In the case of steel bridges, it may be required also because of defective design (usually in the proportioning of details) or by local deterioration resulting from brine drippings, locomotive gases or other cause. The decision as to whether a bridge should be strengthened or be replaced must be based on comparative cost estimates, taking into consideration the added life to be obtained from the strengthened bridge, and with due regard to possible future increases in live loadings.

Wood Trestles

Wood trestles often need strengthening, and this type of bridge is well adapted to it. If the weakness is in the stringers, additional ones can be provided. If they are to be kept in place for only a short time before the structure is to be replaced, they can be added just outside the existing stringers and held in place by drift bolts. If they are to remain in place for some time, the entire chords should be shifted to space the stringers

equally beneath the rails, and longer chord bolts should be put in.

If the number of piles is not sufficient, helper piles can be added. For high bents, they can be driven between the old piling and pulled under the cap. For low bents, either of two methods can be followed. The drift bolts can be cut or pulled and the cap removed, following which new piles can be driven and then sawed off and capped. If the opening can be reduced in size, piles can be driven each side of the cap, close to it, and short cross caps placed over each pair of piles, under the old cap and between the old piles. This method generally requires more material but does not disturb the old bents as much as the first method. In other cases, where the opening can be blocked with reasonable safety for some time, the complete rebuilding of trestles can be deferred by driving new bents between the old ones, using these to support the new deck when the old bents and deck are replaced.

When a large program of strengthening trestles is to be carried out, considerable economy can be affected by doing it with proper equipment. A power outfit for boring holes, sawing, tightening nuts and putting in lag screws is indispensable, and, in some

cases, a light crane, hand-powered or gasoline-engine-driven, can be used economically in placing the timber.

Concrete or stone masonry structures do not generally lend themselves to strengthening. Piers can be enlarged and their carrying capacity can be increased by extending their foundations and encasing their shafts with reinforced concrete. Stone masonry arches can be strengthened by lining them with reinforced concrete, but as in the case of pier strengthening, each case must be considered as a special problem and treated accordingly. If the ordinary types of reinforced concrete slabs or girders are not strong enough, they must be replaced rather than reinforced.

Iron and Steel Structures

Iron and steel structures are generally adapted to a certain amount of strengthening.* In general, the strengthening of a span under traffic is undertaken only to increase the strength of certain weak parts, rather than to strengthen the span as a whole. In work of this character, if it must be done quickly, consideration should be given to the use of falsework for

*In discussing Iron and Steel Structures, Mr. Haggander gave credit to the report of the Committee on Iron and Steel Structures, A.R.E.A., on Methods of Strengthening Existing Structures, for much of the material used. Mr. Haggander was chairman of the committee which prepared this report.

Old Bridges

Present-Day Demands

By G. A. HAGGANDER

Assistant Chief Engineer,
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providing the necessary increased carrying capacity. When falsework is provided, it is possible to strengthen bridges on a line in a very short time, carrying out renewal work later in accordance with an orderly program. Where falsework cannot be maintained, of course, the replacement of these structures must be made first. In this way a replacement program can be spread over two or three years and, in some cases, falsework can be maintained indefinitely. Where falsework is employed, it is, of course, necessary to protect the bridge against the operation of heavy locomotives in the event that the falsework is destroyed by ice or water. As a precaution in this regard, a suitable note should be placed in the bridge limit sheet or operating time card.

Gangs engaged in reinforcing steel bridges should be properly equipped. An air compressor of ample size is indispensable, and other equipment should include rivet busters, rivet buckers, riveting hammers, drills, reamers, power wrenches, and burning and welding outfits, as well as the usual hand tools, scaffold materials, hoists for handling heavy pieces, etc. The size of gang required varies with the type of work involved. When replacing laterals, cross-frames, etc., not requiring interference with traffic, a gang of six men is usually the minimum. Where cover plates are to be renewed, a minimum of 10 men is usually required, while for making extensive repairs to trusses, a gang of 12 or more men may be required.

The physical condition of the structure to be repaired or strengthened must be determined by a careful field inspection. The kinds of metal of which the various members are made should be known, together with their physical and chemical properties. Usually, this may be determined by examining the original drawings and specifications, or test records, al-

though in some cases specimens of the metal must be taken from the structure.

Before the material is ordered for reinforcing, the sizes of the pins, the dimensions of the various members, and the rivet spacing should be checked in the field to find out if they conform to the plans. The unit stresses in the bridge, under the load for which it is to be reinforced, should not exceed 85 per cent of those permitted by the Rules for Rating Existing Iron and Steel Bridges of the American Railway Engineering Association. The stresses in details, as well as those in main members, should be computed.

In adding metal, account must be taken of the stresses which this metal is to carry. Unless the dead load stress is removed temporarily from the member to be strengthened, or some means provided to introduce an initial stress in the new metal when it is applied, the added metal will carry live load only and will not be used to its full strength. Connections of adequate strength must be provided for the added metal.

Members on which work is to be done must be investigated to ascertain if their strength will be reduced by the temporary removal of rivets, cover plates or other parts. When compression members are being reinforced, lacing bars must be replaced before allowing traffic over the bridge. In some cases falsework may be necessary. Furthermore, the sections must be balanced, or full account must be taken of the eccentricity put in members and the permissible stresses limited accordingly.

Plate Girders

Reinforcing may be required in practically any part of plate girders. The end stiffeners may be reinforced by adding angles or plates, grinding the lower ends of the new parts to



Trestles Are Frequently Strengthened By Driving Additional Piles

make them fit closely, or welding them to the flange angles. The flanges may be reinforced in various ways. If the web was not spliced originally for moment, it may be so spliced and considered effective in resisting moment. The flange section may be increased by adding cover plates. If the exposed surfaces of the old cover plates are rough or uneven as the result of corrosion, so that the new plates will not make good contact with them, the new plates should be placed under the old plates and extended out far enough to allow the corroded ends of the old plates to be cut off. The plates may be fabricated in the shop or may be sub-punched in the shop and reamed in the field. If it is impracticable to make accurate and complete measurements of the rivet spacing, the holes may be drilled in the field. To avoid the necessity for falsework in adding or replacing cover plates, the rivets may be backed out and replaced with bolts. The plates can then be put in place and riveted during the intervals between trains.

We find power or impact wrenches to be very valuable in cover plate work. They expedite it and can get into inaccessible places more easily than hand wrenches. Furthermore, we generally use falsework when changing cover plates on spans of 60 ft. or more in length, because the factor of deflection under dead load is a consideration, as well as the amount of time available between trains for making the change.

To expedite the work, the new cover plates for the top flanges are laid on steel brackets fastened to the old stiffener angles. These brackets are long enough to support the old

plates, which, when removed, are slid over the new ones, following which the new ones are slid into place and bolted. These brackets also support plank staging outside the girders at the proper height to allow men to carry out the bolting and riveting work.

Where the cost of the removal and replacement of bridge decks is excessive, as in the case of ballasted decks, the flange section may be increased by adding longitudinal angles just below the flange angles, first cutting off the stiffener angles and then placing new stiffeners between the outstanding legs of the old and new angles. If the bridge seat is wide, the effective span may be shortened somewhat by moving the bearings nearer to the edge of the seat and providing new end stiffener angles over them. Fusion welding may be employed to supplement flange riveting by welding the flange angles to the web to secure good contact between the end stiffeners and the flange angles. It may also be used to strengthen web splices.

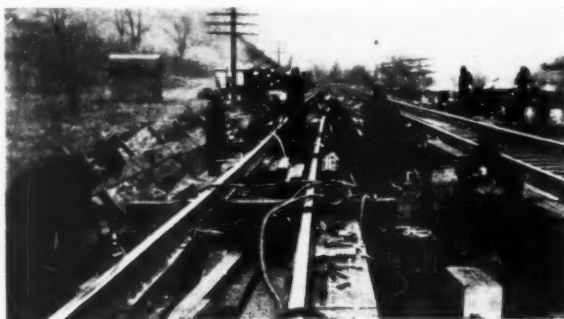
Laterals, Stringers and Floorbeams

Inadequate lateral systems, especially those composed of rods or bars, should be replaced with riveted laterals of the required strength and stiffness. At the present time, with the extended use of heavy, high-speed locomotives, this is one of our principal items of work. Many of our old spans, while having main sections of sufficient strength, have rod laterals and flat plate crossframes, both of which show distress under heavy-high-speed traffic. In replacing these, a design has been worked out for fastening the lateral system gusset plates to the web just below the top flange angle, which avoids disturbing the deck as would be necessary if the plates were to be riveted to the top flange in the usual manner. These plates are usually attached by rivets, although welding is also used extensively for this purpose.

When strengthening deck plate girder bridges having several identical spans, an economical method is to double up the spans, providing additional spans to complete the bridge; or to use three old girders in each span; or to add a new center girder in each old span. When girders are so arranged, the spacing should be such as to equalize the load on them and to allow inspection, cleaning and painting of their inner surfaces. An adequate system of laterals and crossframes must be provided.

Stringer systems may be strengthened by adding cover plates to existing stringers or by adding new stringers. The latter method is commonly used.

The addition of stringers may require the reinforcement of the floorbeams but they give greater strength at the connections to the floorbeams. Stringers so added must be connected to the old stringers so that the old and new ones will deflect together. The spacing of the stringers should be such as to



Adding New Cover Plate to a Deck Plate Girder Span

allow inspection, cleaning and painting of their inner surfaces.

The webs of floorbeams are likely to be over-stressed at their ends, especially in pin-connected truss spans where the ends have been recessed to clear the pin nuts and eye-bars. This detail of floorbeams must be analyzed for both flange and web stresses and adequate reinforcement should be provided.

The end connection of a stringer may sometimes be strengthened by using longer connecting angles and more rivets, by reaming out the holes and using larger rivets, or by welding. Also, brackets may be placed under the ends of the stringers to give additional support.

When cover plates are added to built-up members, either floorbeams or stringers, the flange riveting may be found insufficient. This can be corrected by adding rivets, substituting larger rivets, or by welding the edges of the flange angles to the web. The flanges of floorbeams may be reinforced by adding cover plates, as already discussed in connection with plate girders.

If a floorbeam or stringer has no cover plate, it is possible to weld on plates instead of riveting them. In general, the new plate on the top flange should be narrower than the overall flange width, and that on the bottom flange, wider, to allow down welding. If the cover plate is too thin in proportion to its width to resist buckling, it may be stitch-welded to the flange through holes properly located throughout its face.

In open-floor bridges where the ties rest directly on the flange angles, cover plates may be required because of either insufficient original thickness of the angles or loss of section as the result of corrosion. To keep field

drilling and riveting to a minimum in such cases, the new plates should be relatively thick and the rivets should be spaced close enough to prevent local buckling in compression. Initial tension can be put in a new bottom cover plate by welding one of its ends to the flange angles and then, after

heating the plate until it has expanded to some predetermined length, welding the other end. When the plate has cooled, the remaining welding can be completed.

Where extensive strengthening is to be done on a number of identical girder spans, one new span may be provided and substituted for one of the old spans, which can then be strengthened without the interference of traffic. Continuing the work, each successive span can then be replaced by a span that has been taken out and strengthened in this manner, until the entire bridge has been strengthened. This same procedure can be followed in strengthening the system of stringers in through bridges.

Through Trusses

The strengthening of trusses is more difficult than the strengthening of girders and floor systems. Here, the connections often determine the strength of the span. Tension members may often be reinforced by the addition of adjustable bars. These may be of several types, such as loop bars or single bars attached to a loop or forging that fits over and bears on one-half of the pin. Care must be taken, however, to form the portion of the bar or forging in contact with the pin so that full bearing will be secured. This is generally accomplished by providing excess metal in this portion and boring for the pin holes. Where a bar of uniform section is bent around a pin, its cross section is likely to be reduced by the stretching of the bar and a narrowing of its outer edge. Where this is likely to occur, suitable allowance must be made for it.

To reduce vibration under load, such reinforcing bars should be limited in size to a minimum of about

1½ in. by 1½ in., even though less metal is needed to carry the stress. Where pin room is limited, bars are sometimes placed over the heads of existing eyebars, but this method gives doubtful results because the edges of the eyebar heads are not finished to a true surface. This may be remedied, of course, by welding the new bar to the eyebar head. Where additional bars would be too close to existing bars to allow adjustment, greater clearance may be provided by means of castings, bearing against the existing bars. Adjustable bars may be made a part of the dead load tension in reinforced members.

The reinforcement of compression members requires careful investigation. The chord members of many old bridges are unsymmetrical in section and function as eccentrically loaded columns. This condition may be corrected by adding metal in the proper location. A small amount of metal placed in this way will often increase the rating of the member considerably.

The reinforcement of compression members requiring substantial increases in sectional area calls for special analysis, the solution depending on the type of section, the details at or near the pins, and other conditions. Metal may sometimes be added to the cover plate, usually between the existing lines of rivets, but this must be balanced by placing additional metal on the lower flanges in the manner described previously. Side plates may be added to the existing plates between the upper and the lower angles. If the cover plate in the original design is so wide in proportion to its thickness that it has little resistance to buckling, this may be corrected by adding a cover plate and connecting it to the old plate by stitch rivets along its center line, in addition to rivets through the angles.

One of the problems encountered in reinforcing compression members is to introduce the dead-load stress into the additional material. If this is not done, full value cannot be obtained from the new material. For example, assuming that the new material gets no dead-load stress, that the dead-load stress in the old material is 10,000 lb. per sq. in., and that the total allowable stress is 26,000 lb., then the new material will be carrying only 16,000 lb. stress, produced by live load alone. This is the maximum stress to which the new metal can be worked, since any higher stress would cause overstress in the old metal.

Several methods may be used to meet this condition. The one employed most commonly in heavy reinforcing work is to calculate the shortening necessary to produce the desired stress under dead load, and

then to drill the holes in the old and the new members in such position that the new members will be shortened by drifting before the rivets are driven. Another method, which is used on upper chords and end posts, is entirely different from that already mentioned and can be used only for large members. Here, the cover plates may be thin compared with their unsupported width and it is desired to use a method that will bring all of the old metal into full use. The reinforcement in this case is provided in the form of a new central web, with top and bottom flange angles, but is divided into two segments, each occupying one-half of the panel length. The segments are designed to receive a wedge between their adjacent ends, and are placed inside the member with their ends bearing against the pins and the wedge. Compression is then introduced in the segments by pulling the wedge up tight by means of a large bolt. The wedges are then slacked off and pulled up to a snug fit, after which all the wedges in one chord are drawn up simultaneously a predetermined amount to develop the dead-load stress in the new metal. The bolts holding the wedges are left in place permanently. The flanges of the new segments are riveted to the top cover plate and to the lower lacing bars, thus



Tightening Loose Diagonals in a Pin-Connected Truss by Turnbuckle Assemblies

making the new center segment an integral part of the chord, carrying the same stress per square inch as the old metal.

The reinforcement of deck truss spans is frequently accomplished by the addition of a center truss. In a single-track bridge this is comparatively simple, as ample bracing may be applied to make the three trusses deflect alike. The center truss should not be too stiff but should have the same deflection under load as the old

trusses. Otherwise, excessively heavy cross bracing will be required or excessive stresses will be induced in the center truss before the outer trusses have deflected enough to stress the members up to their carrying capacity.

The addition of a center truss in a double-track deck truss span that has only two trusses creates difficult problems. Here, the tracks may be loaded either separately or simultaneously, and it is not economical to introduce enough bracing between the trusses to make them act together. The floorbeams will be continuous over the new truss. If the center truss is too stiff, the outer truss will have greater deflection under a single-track load, and the outer rail will be low under load. When both tracks are loaded, however, the center truss must be strong enough to carry its share of the load from both tracks. Thus, the truss deflections and the distribution of stresses through the floorbeams for various conditions of loading must be determined and a design chosen in which the different members will be under as nearly equal stress as possible without introducing objectionable deflections and poor riding track.

Welding

Considerable use is being made of electric arc welding in the strengthening of bridges. This method is still in the early stage of development, but it has great possibilities and will be extended as the art is improved. For the present it would be well to confine it to details and points where failure of the weld would not result in complete failure of the structure. Welds should be employed in such a way that they are subjected only to shearing or compressive stresses. Butt welds in tension should not be used. Welding in bridge reinforcement is done under conditions which are much less favorable to good workmanship than welding done in shops. The welder on a bridge must contend with rain, wind, unfavorable temperature, vibration of the structure, and often work at great heights in cramped positions on scaffolding.

On the Burlington, we have used three portable gasoline-engine-driven arc welding sets on bridge repairs and construction for more than 10 years. On old structures they are used largely to replace deteriorated stiffener angles; to weld patches over thin spots in webs; to reinforce the ends of floorbeams and gusset plates where the design is light or where deterioration on account of brine has occurred; to repair the bottom flanges of overhead signal and highway bridges; in the placing of cover plates on stringers and floorbeams and other purposes.

What Can We Expect From Treated Ties?



Ties Are Removed from the Woods to the Treating Plant Promptly Where They Are Seasoned Under the Most Favorable Conditions

Conditions of track, roadbed and climate, all of which affect tie performance, vary. Although many roads have similar tie conditions, no two roads are exactly alike in this respect. Therefore, I shall confine my discussion to those ties with which I am most familiar—the 60,000,000 ties that form the backbone of Santa Fe tracks, and our present-day tie practices which have been evolved from 55 years of tie treatment and 38 years study of tie test tracks.

Preservatives and Processes

Our first treating plant was built at Las Vegas, N. M. in 1885. In that year, 111,503 Western pine ties were treated by the Wellhouse process, a combination of about one-fourth pound of zinc chloride per cubic foot of timber with glue and tannin. In 1892, the amount of zinc chloride was increased to one-third pound. In 1901, the Wellhouse process was abandoned in favor of 0.5 lb. of straight zinc chloride per cubic foot, which was our standard treatment until 1906 when a 4½-lb. creosote Rueping treatment was adopted. The net retention of this preservative by this process was increased to 5 lb. in 1909, and this treatment was used until 1915 when, because of the war, it was necessary to return to the 0.5-lb. zinc chloride treatment until creosote was again available. Towards the latter part of this period, we treated about 25,000 ties with 0.5 lb. zinc chloride and 5 lb of petroleum per cubic foot, and

about 112,000 ties with zinc chloride, creosote and petroleum in the proportion of 0.5 lb. zinc chloride and 5 lb. of 30-70 per cent creosote-petroleum mixture. Later, we treated additional ties with zinc-petroleum. Incidentally, both combinations were improvements over the straight zinc chloride.

In January, 1923, we made the creosote-petroleum mixture standard. In reaching this decision, we were guided by results obtained from approximately one million Western pine ties which had been given a mixture treatment at the Albuquerque plant from 1909 to 1913. A 7-lb. net retention of a mixture of 70 per cent creosote and 30 per cent petroleum was first decided upon for the ties to be treated at our Somerville plant, and a 7-lb. net retention of a 50/50 creosote-petroleum mixture for the ties to be treated at our Albuquerque plant, the ties from the former plant going into tracks in territories having greater rainfall than that served by the Albuquerque plant. A year later, these standards were revised to an 8-lb. 50/50 creosote-petroleum treatment at the Somerville plant and an 8-lb. 45/55 creosote-petroleum treatment at the Albuquerque plant, and also at the plant at National City, Cal., which had been constructed in 1923. In 1930, a treating plant was constructed at Wellington, Kan., and the same treatment has been used at this plant as at Somerville. These four plants are now in operation and the treatments adopted in 1924 are our present standards.

By G. W. Harris

Chief Engineer,

Atchison, Topeka & Santa Fe System

In this paper, presented before the annual convention of the American Wood-Preservers' Association in St. Louis, Mo., on January 24, the author throws much light on this question out of the experience evolved by the Santa Fe through 55 years of tie treatment and 38 years of study of test tie installations. He also describes present Santa Fe practices in tie purchases, treatment and installation, which have grown out of these long years of experience

During the 55-year period from 1885 to 1940, we have treated at our own plants, and have had treated at commercial treating plants a total of 116,521,467 crossties; in addition to our requirements of piles, switch ties, bridge timbers, crossing plank and miscellaneous lumber.

Tie Test Installations

Like wood preservation activities in general, our treating practice was at first some years in advance of our crosstie research, which started 17 years later with the installation of a tie test track at Cleveland, Tex. Our tie tests, which have developed from this beginning, may be divided into three general classifications, as follows:

(1) Those comprising complete section foremen's territories, generally one on each operating division.

(2) Those known as the A.R.E.A. tests, the conditions of which are reported from time to time by the Wood Preservation committee of the American Railway Engineering Association, and by the Tie Service Records committee of this association.

(3) Other tests inaugurated for special purposes.

The tie tests falling under the first classification total 26 in number and each consists of a section foreman's district as it existed in 1910 when these tests were first laid out. These test sections total 165.3 miles of main tracks and 19.5 miles of side tracks, in which there are now 544,175 ties in main tracks and 48,866 in side tracks, a total of 593,041. Including the test ties still in track, these test sections have provided for the study of a total of 1,278,591 main track and 88,183 side track ties of various woods and treatments. When the ties in these sections reach the limit of their service life, the replacement ties are taken into the records and these test installations are, therefore, perpetual in nature.

In this respect, these test sections differ from the A.R.E.A. tests in which no attempt is made to follow up the ties laid in replacement of the original ties, the A.R.E.A. tests being comprised of out-of-face installations in which tie service life, kind for kind, is generally longer than in the test sections. The A.R.E.A. tests range in length from short stretches up to 90 miles of line, and total 181.5 miles of main tracks, containing 428,235 test ties, plus ties that have replaced test ties that have failed and which are included within the limits of these tests, although not carried in the records of the test. To date, a total of 579,235 test ties have been reported in the A.R.E.A. tests.

The Kingman, Ariz., Test

Under the third classification of tests inaugurated for special purposes, we have 13 tests, including 7 stretches of untreated ties of foreign woods, which incidentally, have not given the service life in our tracks that we were led to expect by reason of their excellent performance in the countries in which they originated. The other tests in this group are designed for the comparison of service life of ties of various woods and treatments under similar conditions of climate, traffic and track conditions. One of these tests is located at Kingman, Ariz., in a climate of light rainfall, and was installed in 1922 at the time of second-track construction. The ties in this test are arranged in units of 100, each unit embodying ties of the same wood and preservative treatment. Ties of each wood were treated with 7 different treatments, and there are 14 different kinds of wood in the test. To provide against loss of data resulting from derailments, dragging brake beams, etc., this test was laid out in duplicate, each of the two sections being approximately 6 miles long; they are 10

miles apart and are on tangent track. The Kingman test also includes sawn and hewn oak and gum ties of various treatments, laid out in groups of 200 each in some 4,000 ft. of curved tracks, to permit comparison of hardwood ties of various treatments under curved track service. The Kingman test also embraces one mile each of test ties of various woods and treatments in ascending and descending grades, each group of ties in the ascending track being opposite a similar group in the descending track. To date, 35,349 ties have been studied in the Kingman test, of which 28,770 are still in track.

It may prove interesting to note briefly the standing of the various treatments in this installation at the end of 17 years in track. This is indicated by the percentage of the ties

at Kingman was established near Eldorado, Kan., in 1923 in connection with the construction of a new line. The Eldorado test track is 8.2 miles in length and contains ties of about the same woods and treatments as the Kingman test, except that zinc chloride and combinations of zinc chloride were omitted because we already had ample data on the effectiveness of this particular treatment under climatic conditions comparable to those at Eldorado where the rainfall is much heavier than at Kingman. To date, 27,166 ties in the Eldorado test section have been studied, 25,498 of which are still in track.

Altogether, the tie tests I have mentioned, including the one at Eldorado, Kan., total 455 miles of track and two and a quarter million ties have been tested and have gone into

Record of Ties in the Kingman, Ariz., Test After 17 Years

Treatment	Number of ties	Percent removed to 1-1-39	Average life to 1-1-39
Zinc chloride.....	2,594	98.61	8.89
Zinc chloride-petroleum.....	5,356	40.74	14.53
Zinc chloride, followed by 30/70 creosote-petroleum mixture.....	5,149	30.43	15.12
Creosote-Rueping, 5 lb. net retention.....	8,144	11.36	15.79
Creosote-Rueping, 7 lb. net retention.....	5,966	5.48	15.95
Creosote-petroleum 50/50 Rueping, 7 lb. net retention.....	7,741	4.95	15.87
Creosote-petroleum 50/50 Boulton, Douglas fir only.....	399	3.01*	15.96*

*399 ties in double track, Douglas Fir only.

of each treatment removed to January 1, 1939, and the average life in track to that date.

It is too early to compare kinds of wood for the reason that only small percentages of the better treatments have been removed to date. The zinc-treatment ties have practically finished their service life and have given an average life of 8.89 years. As is evident, the addition of petroleum or of a creosote-petroleum mixture in rather small amounts to the half-pound of zinc chloride has added materially to the life of the straight zinc chloride-treated ties.

Another duplicate installation employing the same grouping of ties as

the records of the tests. Of these, 1,126,936 are still in service. In these tests are included ties treated with 40 preservatives or combinations of preservatives, ties of 31 species of American woods, and ties of 4 species of foreign woods.

Annual Tie Renewals

As a yardstick for tie performance in general we have, in common with other roads, carefully studied the annual tie renewals on the system. Time will not permit a full discussion of our tie renewals, of which we have an accurate record back to 1898. It is of interest, however, to note that

A Section of Well-Tied, Well-Maintained Track on the Santa Fe Between Heman, Okla., and Mooreland





A Part of the First Tie Test Section of Track on the Santa Fe, on the Beaumont Branch, at Cleveland, Tex., Installed in 1902

in that year tie renewals per mile of all tracks were 330. Beginning with 1899 and taking five-year periods through 1938, average renewals per mile for these periods have ranged from 260 to the mile in 1904-1908, to 100 in the period 1934-1938. Using an average of 3,036 ties per mile of all tracks, an average tie life, based on these figures, ranges from 11.68 years in 1904-1908 to 30.36 years in 1934-1938. A tabulation of these eight five-year periods follows:

Tie Renewal Averages and Tie Life, Five-Year Periods, 1899 to 1936			
Five-Year Period	Average Renewals per Mile all tracks	Indicated based on 3,036 ties per Mile all tracks	Ave. life
1899-1903	211	14.39	
1904-1908	260	11.68	
1909-1913	250	12.14	
1914-1918	180	16.87	
1919-1923	149	20.38	
1924-1928	126	24.10	
1929-1933	113	26.87	
1934-1938	100	30.36	

These figures afford an indication of the progress which has been made in extending tie life during the last 40 years.

While preservative treatment is the most important factor in obtaining the maximum service life from our crossties, the mechanical protection of our ties is of almost equal importance, and, under some conditions, is even more essential than preservative treatment. Time will not permit the discussion of this factor of tie life to the extent that its importance deserves, but mention should be made of the importance of tie plates of suitable size and design, and of the preboring and adzing of the ties for the spikes, and proper plate seating. Further, it has been a standard practice with us since 1927 to pre-groove all ties to permit complete initial seating of the tie plate rib in order to prevent damaging the treated tie fibres which occurs if this is not done. Good drainage and ballast of the proper type are also highly important factors in crosstie performance.

On the Santa Fe, we are convinced of the importance of careful and effi-

cient handling of the crosstie from the time it reaches the right-of-way until its service is complete. Trained men from the staff of the system manager of treating plants, experienced in the treatment and care of timber, co-operate with division engineers, roadmasters, extra-gang foremen, section foremen, and others, to the end that adzing of the ties in track, mopping of the plate seats with a hot creosote-petroleum mixture, driving of tie plugs, spiking,

etc., are carefully and skillfully done.

Another practice that is designed to insure that the maximum life of ties will be obtained, involves the inspection of ties that have been removed from track, to determine the causes of failure of each kind of wood and treatment, and to make sure that such ties have not been taken out prematurely. While it is not possible to inspect all ties that are removed, an effort is made to inspect a representative number. This study of ties taken out of track has proved of value in the development of our practices with respect to treatment and the selection of tie woods for the various climatic, traffic and track conditions over the system. For example, of about 141,500 creosote-treated ties that have been taken out of track over a period of several years, 48 per cent had failed on account of shattering and 44 per cent due to spike killing, while only 0.4 per cent failed primarily on account of decay. The high percentage of creosoted ties failing on account of shattering was one of the primary reasons for our going to the

creosote-petroleum mixture treatment, which tends to prevent sun checking and shattering.

Specifications and Inspections

Along with the development of treating practices and mechanical protection of our crossties, there has been a corresponding development in the specifications for, and the inspection and distribution of our crossties. Our crosstie specification is based on many years of general experience with ties of various kinds of wood, supplemented by our test track studies, and excludes ties with defects that our tests and experience have proved will not stand up in service. Each tie is carefully inspected by purchasing department inspectors before acceptance, and those that do not meet our specifications in every respect are rejected. When the purchasing department inspectors accept a tie, letters and figures representing the month in which the tie was cut, the inspector who accepted the tie, and the grade at which it was accepted, are stencilled on its end with paint. These marks are an aid in the proper seasoning of the ties at the treating plants, and to check as to quality and adherence to the specifications that are made from time to time. The ties are moved from the woods to the seasoning yards at the treating plants within 30 days from the date of inspection. This is done to guard against incipient decay before the tie reaches the plant seasoning yard. In general, only ties produced in the same month are placed in the same stack for seasoning, but, if necessary to conserve space, ties produced in two consecutive months may be placed in the same stack, but not more than two months' cutting to the stack. Only ties of one kind of wood may be placed in the same stack.

Ties are stacked in the seasoning yards in a manner to permit full circulation of air, and in accordance with the recommended practice of your association and the American Railway Engineering Association. Periodic inspections are made to determine when the ties are ready for treatment, and their general condition, and in this connection, laboratory tests and the weighing of ties before treatment are used regularly to determine the moisture content. In fact, I call attention particularly to the fact that every charge of ties treated at our plants is weighed before and after treatment, and weights above the average are investigated immediately. I cannot emphasize too strongly the importance of thorough seasoning prior to treatment.

Prior to 1922, not a great deal of consideration had been given to the distribution of ties of the various woods available to this railroad, other than the length of haul from the sources of supply. In that year, a committee appointed by our operating vice-president, of which it was my privilege to serve as chairman, made an exhaustive study of the hard and softwood ties available and the distribution of these woods as to kinds and sizes, which resulted in the assignment of the various species available to those portions of the system to which they are best adapted with respect to availability and climatic and service conditions.

Distribution

Special attention has been given by the Santa Fe to the distribution of hardwood ties to insure that they are used where service conditions are most severe, such as curves of one degree and over, engine leads, and other important tracks in yards, etc. At the present time our tie map is in the process of revision owing to the recent adoption of 9-ft. ties for use in our high-speed and heavy-traffic main tracks, curves and tangents, between Chicago and Los Angeles, Cal., via both La Junta, Colo., and Amarillo, Tex., and in curves only, in other less important main lines.

During the last several years there have been decided increases in the speeds of both passenger and freight trains. When I saw this coming, I made an intensive study to determine what should be done to the track structure to bring it up to the standard required for the faster speeds. As to ties, I recommended the adoption of 9-ft. lengths of 7-in. by 9-in. sawn and 7-in. by 8-in., hewn ties in place of 7-in. by 8-in. by 8-ft. ties, and my recommendation was approved. A 9-ft. hewn tie provides 12 per cent more bearing area on the ballast than a 7-in. by 8-in. by 8-ft. hewn tie and the longer and wider sawn tie gives 26 per cent more bearing. The 9-in. width will also reduce tie splitting.

What Life?—Treated Ties

As I have indicated before, Santa Fe methods and standards with respect to tie specifications, preservatives, methods of handling, distribution, etc., are not the result of any one study or action, but of an evolution based on a study of the subject for over half a century. Now you may ask, what tie life will be obtained from ties produced, treated and handled according to our present stand-

Mixture-Treated
Hewn Texas
Pine Ties in a
Tie Test Section
on the Coast
Lines of the
Santa Fe, East of
Acomita, N. M.



ards. That I can only indicate from a study of our tie records and our general experience and observation in the past, estimating as best one may the favorable effects of the im-

proved life of the ties of each treatment by means of this curve, or using the actual average life where ties of any group have completed their service life, and eliminating from these computations all groups of ties that have not been in track ten years, or the renewals of which

Average Expected Life of Ties Given Various Preservative Treatments

Kind of Treatment	Number of Ties in Calculation	Placed in Track During the Years	Average Expected Life—Years
Zinc chloride	314,252	1886-1925	13.47
Zinc chloride-petroleum—two movement	13,463	1915-1926	19.48
Zinc chloride-petroleum-emulsion—Howald process	2,926	1925-1926	19.76
Zinc chloride, followed by 30/70 creosote petroleum mixture	16,851	1922-1926	20.76
Creosote, 5 lb. net retention	790,034	1904-1929	27.88

provements that have been made in recent years in ties, treatment and methods that have not yet had time to demonstrate their value in our tracks. Among such items, perhaps the most important are larger and longer ties, increase in the size and improvement in the design of tie

pected life of the ties of each treatment by means of this curve, or using the actual average life where ties of any group have completed their service life, and eliminating from these computations all groups of ties that have not been in track ten years, or the renewals of which

Record of the Creosote-Petroleum Mixture
Treated Ties 1909-1915

Year Inserted	Original Number Inserted	Total Removed	Per Cent Removed	Average Life in Track to 1-1-38	Expected Average Life*
Sawn Western Yellow Pine Ties. Treatment, 10 to 12 lb. per cu. ft. 30/70 Creosote-Petroleum Mixture					
1910	2,266	572	25.24	23.86	35.53
1911	2,259	909	40.24	20.54	30.59
1912	145	95	65.52	17.21	24.04
Total	4,670	1,576	33.75		
Hewn and Sawn Western Yellow Pine Ties. Treatment, 7 lb. per cu. ft. 50/50 Creosote-Petroleum Mixture					
1912	119	41	34.45	21.51	30.86
1913	9,396	843	8.97	22.90	+
1914	712	123	17.28	21.21	32.86
1915	734	245	33.38	20.15	27.16
Total	10,961	1,252	11.42		

*Based on Forest Products Laboratory Curve. †Percent renewed is beyond the limits of the Forest Products Laboratory curve for treated ties.

plates, heavier rail, better ballast and drainage, rail anchors, etc.

In order to estimate what we can expect from our treated ties, I have consolidated the results from ties of each treatment and kind of wood, on the basis of life to date, extended in

have not exceeded ten per cent, the averages of expected life for ties of all woods in each of the principal treatments we have used, are shown in the above table.

In the foregoing comparisons I
(Continued on page 94)



Looking Backward
Along the String of
Flat Cars as the
Last Rails Were
Being Loaded

WHEN confronted last spring with the problem of transferring 1,400-ft. lengths of butt-welded rails from ground-level storage beds to flat cars for transportation to the site of installation, the Delaware & Hudson devised an ingenious method by means of which 31 such lengths, divided between two trains of flat cars, were loaded without mishap in somewhat less than two working days. The method employed was essentially a reversal of the procedure that is commonly used to unload such rail from

flat cars by pulling the cars out from under them. In brief, it involved as the first step the elevation of the ends of the rails onto a ramp terminating in a bridge which spanned a track extending in a direct line with the storage bed. This track was connected, by means of reverse curves, with a tail track placed parallel with, and extending the length of, the storage bed. To load the rails the string of cars was simply backed into the tail track, the ends of the rails (two at a time) were attached to the loco-

motive and the latter moved slowly forward to pull the rails up over the ramp and onto the cars.

The rails involved in the work were of 131-lb. section and were welded at Schenectady, N. Y., in the fall of 1937 by the electric-flash method of Sperry Rail Service.* Originally, it was planned to insert them in track at Cobleskill, N. Y., where a grade separation project necessitated a short change of alignment, but it was later decided to use the old rail on the new alignment, thus releasing the butt-welded rails for insertion elsewhere. Then followed the decision to insert them as part of the 1939 rail-renewal program in the double-track main line at Plattsburg, N. Y., where they were divided about equally between the two main tracks. Plattsburg is approximately 145 miles from Schenectady and the alignment between the two points embraces a maximum curvature of 12 deg., as well as numerous reverse curves. That the 1,400-ft. rails, the longest continuous lengths yet to be moved on flat cars on the Delaware & Hudson, were transferred to the point of installation without other than minor difficulties was regarded as another demonstration of the feasibility of transporting continuous rails long distances.



Showing How
the String of
Flat Cars and
the Lines of
Rails Converged
at the Bridge
(In Foreground)
During Loading
Operations



This View
Shows How the
Long Rails
Were Dragged
Over the Bridge
and Onto the
Flat Cars

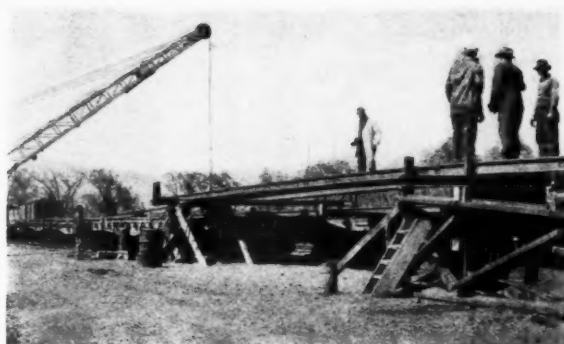
Early Practice

When the electric-flash butt-welding process was first introduced on the D. & H., the practice was to carry out the work on side tracks at a loca-

*This method, as it was applied to the butt-welding of rails on the Delaware & Hudson, was described in detail in the September, 1937, issue of *Railway Engineering and Maintenance*.

Ingenious Method in Loading 1400-Ft. Rails

In 1937 the Delaware & Hudson butt-welded a considerable quantity of 131-lb. rail into 1,400-ft. lengths and stored them on a rack at the ground level. When it became necessary in the spring of 1939 to load the rails on flat cars, a method was devised by means of which this task was accomplished without difficulty and in a highly expeditious manner. The details of this ingenious method are described in this article



tion as close as possible to the point where the rails were to be installed and to transfer the welded rails immediately to strings of flat cars. This practice, however, had certain disadvantages. For instance, as the flat cars on which the rails were stored could not be released until the rails were laid, the result was that they were in some instances tied up for considerable periods. Also, the lengths into which the rails could be welded were limited by that of the side tracks that were available for the welding work. In view of these considerations the railroad came to the conclusion that much could be gained by carrying out the welding operations at a point where the long rails could be transferred immediately to a suitable storage bed, thereby dispensing with the use of flat cars except in transporting the rails, and reducing the number and length of side tracks required. It is also apparent that, with this policy, butt-welding operations can be carried out at any convenient time, thereby relieving the railroad of the necessity of correlating the welding work with the rail-laying operations.

In the butt-welding of the rails for the Plattsburg installation it was decided to put this idea into practice and a location was chosen at Schenectady which appeared to embody all the necessary qualifications for a storage bed. This location was on the site of an abandoned yard, the tracks of which had been removed, leaving an

Right Above—In This View of the Loading Operation the End of the Ramp Structure Can Be Seen at the Right and the Bridge in the Center Background—Right—Lateral Adjustment of the Rails on the Flat Cars Was Achieved With the Aid of a Crawler Crane



expanse of flat surface of the desired length. At one end of this site and directly in line with it was an existing yard track on which the welding train was arranged.

The Storage Bed

To prepare the storage bed for receiving the strings of welded rails, a series of transverse skids or supports, placed on 25-ft. centers, were installed throughout the length of the bed. Each of these skids resembled a short section of track, consisting of two 33-ft. scrap rails placed parallel with each other and spiked to timber cross-ties. The storage bed was on a grade of one per cent ascending from the receiving end, and care was taken in its preparation to insure that a uniform support would be provided for

the welded rails. To provide a means of lowering the strings of rails to the storage bed as the welding work proceeded, a ramp was constructed at the receiving end of the latter. At its lower end the ramp was supported on a fill, while the remainder was constructed of scrap rails with bolted connections. The latter portion was about 30 ft. long and, as supports or skids for the welded rail, it embodied four transverse members spaced about 10 ft. apart. In width, the scrap-rail portion of the ramp tapered from 33 ft. at its lower end to approximately 10 ft. at the upper end, which was about at car-floor level.

As each line of welded rails increased in length during the welding work it was drawn down over the ramp and on to the storage bed by means of a cable winding on the drum

of a motor-operated winch placed on the center line of the bed at its extreme opposite end. Power for the winch motor was furnished from the generator car of the welding train. When the welding of each of the continuous rails had been completed, it was moved over to one side of the storage bed to make room for the next. In preparing the site of the storage bed for loading the rails a number of changes in the track layout were required, which included, in addition to certain minor alterations, the construction of a tail track extending along one side of the storage bed for its full length and the installation of a connecting track, involving 12-deg. reverse curves.

Other preparatory work included the construction of a portal-like frame or bridge spanning the connecting track at a point 40 ft. from the end of the existing ramp. The function of this structure was to provide a transverse support spanning the connecting track in such a position that the continuous rails could be drawn up over it from the ramp and on to flat cars moving in from the tail track, around the reverse curves and under the bridge.

This structure was built for the most part of heavy timber posts and braces, with the principal supports consisting of A-frames on each side of the track. To impart stability to the structure, particularly against the overturning forces transmitted through the crossbeam of the bridge during the movement of the rails over it, the lower ends of the inclined members of the A-frames were tied together by timbers extending under the track. The overhead crossbeam of the bridge was a composite member made up of a number of scrap rails. It had a clearance above the track (top of rail) of 5 ft. 4 in., and the maximum clear span was 12 ft., although the total length of the transverse member was 20 ft. 4 in. The preparatory work also included the strengthening of the existing ramp by the application of additional scrap-rail cross bracing where needed.

Loading Procedure

As a preliminary step in the loading of the rails, a portion of them were pulled forward up over the ramp until their ends rested on the transverse member of the bridge, a crawler-mounted crane being used for this purpose. The actual loading operation followed, in which a string of 41 flat cars, each with two transverse skid rails spiked to its deck, was backed under the bridge into the tail track to a point where the locomotive was brought in close proximity to the ends

of the rails on the bridge. The rails were then loaded two at a time by fastening them to the locomotive coupler and moving the train forward slowly. The method of attaching each rail to the locomotive involved the use of a clevis on the end of a cable reaching to a cable sling attached to the



One of the Rail Trains Being Unloaded at Plattsburg, N. Y.

coupler. At first the clevis was attached directly to the rail, with the clevis bolt extending through a hole drilled in the web of the rail, but it was soon noted that the bolt had a tendency to bend. This difficulty was overcome by applying a pair of angle bars to each rail end and attaching the clevis to the extended ends of the bars, thus providing two points of bearing for the clevis bolt instead of one.

As each pair of rails was being loaded, their lateral adjustment on the flat cars was accomplished with the aid of a crawler-mounted crane. However, this operation was considerably simplified after it was noted that at a certain point in the movement of the cars around the curves into the tail track the rails had a tendency to move laterally to one side of the cars. It occurred to those in charge of the work that, by placing stakes in the proper end pockets of the cars as they passed this point, the rails could be fixed in the desired lateral position. Accordingly, a laborer was assigned to this task, who maintained himself at the desired point on the curve by walking along on the cars in the direction opposite to their movement.

Because of the width limitation of the flat cars it was not possible to load all 31 rails at one time. Hence, the rails were loaded and transported in two installments, 16 of them being hauled on one train and 15 on the other. Using a crew of nine men, including one foreman, two assistant

foremen and six laborers, the first installment of the rails was loaded in about eight hours, but only about six hours were required for loading the second group.

Transporting the Rails

The rails were transported the 145 miles to the point of installation at speeds ranging up to 20 miles per hour. In spite of the fact that the route of travel embodied numerous curves ranging in sharpness up to 12 deg. and that at three different locations there were a considerable number of reverse curves, no difficulty was experienced because of lateral movement of the rails. The only difficulty that was experienced occurred when one of the outside rails on one of the trains moved backwards about a car length while the train was ascending an 0.62 per cent grade about 6 miles long. However, as two extra cars, including a flat car and a drop-end gondola, had been inserted between the last rail car and the caboose with such an eventuality in view, the effect of this occurrence was minimized. The rail that had shifted was simply fastened at the head end of the train in the new position with a cable and the trip resumed.

The rails were unloaded by the usual method of anchoring the ends and then pulling the train out from under them, one of the lines of rails for each track being deposited on the outside of the track on blocking previously provided and the other being placed in the inter-track space. A noteworthy feature of the unloading work was involved in the use of a rail bender as a means of anchoring the ends of the continuous rails to the track rails. In preparation for inserting the new rails, the spikes holding the existing rails were removed, the old rails were barred over into the center of the track, the tie plates were removed and the ties were adzed. The continuous rails, to which new double-shoulder tie plates and M & L fastenings had been attached previously, were then lifted into position. A total of 43,523 lin. ft. of rails, embodying 1,071 flash butt welds, was involved in this project.

The work of loading, transporting and laying the rails installed at Plattsburg was planned and executed under the general supervision of P. O. Ferris, now chief engineer of the D. & H., whose title was then engineer maintenance of way. The method of loading that was used was devised by C. E. R. Haight, now engineer of track, and the work of loading the rails was carried out under the supervision of Mr. Haight and J. O. Suprenant, roadmaster at Schenectady.

When To Insulate Existing Buildings*

By E. L. Rankin

Architect

Gulf, Colorado & Santa Fe, Galveston, Tex.

HEAT always moves in the direction of lower temperature, that is, toward colder objects or spaces. It travels in three ways, by radiation, through space, independent of air currents; by conduction, which is the transfer of heat from one object or one molecule of matter to another; and by convection, illustrated by the outward and upward currents of heated air. To confine heat within a building or any other space, all three of these means of heat travel should be stopped as completely as possible.

It is practicable from a physical viewpoint to insulate an existing building by means of double glazing, weather stripping and the application of insulation, provided the building is sound structurally. Whether it should be done will depend on the use to which the building is put and whether this use will justify the expenditure. These facts can be determined only by a careful survey and analysis of the structure by a qualified inspector who will determine the extent of the alterations and repairs that will be necessary, and the insulation to be used.

He should also determine the amount of the saving that can be effected and the extent of the greater comfort that will be experienced if the work is done. In the report of the Committee on Insulation, which was presented at the convention of the American Railway Bridge and Building Association in 1938, and which appeared on page 710 of the November, 1938, issue of *Railway Engineering and Maintenance*, examples are given of the insulation of existing buildings, in which savings had resulted in the consumption of fuel, while the comfort and efficiency of the occupants had been increased. In some cases it had been possible to decrease the size of the heating plants, and in others, certain buildings or parts of buildings had been made usable that could not have been used

without an increase in heating costs.

Insulation should be installed in an existing building if the building is structurally sound and it can be shown that both comfort and economy will be increased. In a building in which the inside air and the contents are at a higher temperature than the outside air or the outside surface of the structure, there will be a continual loss of heat through the walls, roof and floor as long as the temperature difference is maintained. If the temperature inside the building is to be maintained, this heat loss must be made up by the heating system as rapidly as it is lost. It is evident, therefore, that no matter how effective the heating system is, if the building is poorly constructed and allows the heat to leak away rapidly, the heating cost will be higher than for a building that has a lower rate of heat leakage.

Modern living standards demand the maintenance of constant, comfortable temperatures in buildings that are occupied. The high cost of fuel and of heating equipment point to the need for economy in heating, while high building costs point as strongly to the need for economy in construction. Some of the expense for fuel and for the heating plant can be reduced by the use of insulation. The problem then resolves itself into the means for obtaining the desired conditions with the lowest interest on the building investment, including the heating plant, and low fuel cost.

Those roads that are located in cold climates are more interested in insulation to make a saving in the size of the heating plant and in reducing fuel costs and, at the same time, increasing comfort in winter and to some extent reducing condensation.

Stop All Leaks

To aid in preventing heat losses, all cracks in door and window frames should be caulked, and either weather stripping or tight-fitting storm ash should be used on all windows. These items are in addition to the application of insulation to walls, ceiling, roof and floors. It should not be overlooked that, aside from leakage and radiation, any circulation of air in the studding space and between ceiling joists may easily reduce the effectiveness of insulation. In north-

ern climates where low temperatures prevail in winter, the problem of condensing moisture under the roof will have a bearing on the placement of the insulation. Condensation results when warm, moisture-laden air comes in contact with cold roof surfaces. While there are many factors that may affect a condensation problem, generally speaking, difficulties of this kind can be avoided by placing the insulation between the roof rafters or, if the insulation is placed in the attic floor, by providing ventilation openings in the attic to carry away the warm, moist air.

Since heated air rises naturally, the greatest heat loss per square foot of exposed surface is likely to take place through the roof, and during the summer most of the heat gets into the



Blowing Loose-Fill Insulating Material In Place Between Roof Rafters

building in the same way. For these reasons, it is advisable that the insulation of the roof be given consideration. It is well to insulate all roof areas or decks over heated areas, and to insulate floors over unheated areas. The board and blanket types of insulation cannot be applied in the walls of existing buildings unless extensive remodeling is undertaken, involving the removal of the original wall finish. However, these types can be applied on or between roof rafters, on the attic floor joists or to frame walls or on furring strips over masonry.

Board insulation can be used as a plaster base or as an interior finish without plaster, either in its natural finish or with a paint finish. Loose-fill materials are used to fill the space between studs, joists or rafters. To insulate the walls of an existing building with a loose-fill insulating material, it is only necessary to remove a strip of siding near the top of the wall and pour or blow the insulation into the space between the studding, and then replace the strip of siding.

*This discussion was submitted for publication in What's the Answer department in a previous issue, in answer to the query as to what extent it is practicable to insulate existing buildings, and how it should be done, but because of its scope it was withheld for presentation here as an independent article. For further discussion of this subject see page 534 of the September issue, 1939.

Correctly-applied insulation having good characteristics and of adequate thickness and tight construction, will help to prevent condensation, will minimize heat movements and permit closer control over interior temperatures in both summer and winter, thus assuring more uniformly comfortable working conditions throughout the year. The insulated building is also

protected against the effect of high winds which so often cause discomfort in the non-insulated building, even when the outside temperature is not particularly low. Insulation also reduces the consumption of heating fuel and the size of the heating plant. Certain types of insulation are fire resistant and, therefore, make good fire stops, especially in frame buildings.

While, so far, physical breakdown has been stressed, it is a fact that the ratio of failed rails to the total of those in service is small. On the other hand, those failures that do occur are of real importance because of the possibilities that may follow the failure of a rail under traffic. The length of time or the amount of service necessary to bring out failures in physically unsound rails is indeterminate. No known rule can be followed, even with fissures. We know in general, however, that the development of these failures is in approximate ratio to the volume of traffic passing over the rails, but it cannot be predicted at what point any individual physically impaired rail will fail. The necessity for constant watchfulness is, therefore, apparent. Again, in general, any lot of rails does not develop an abnormal number of failures, except that this may occur in isolated heats, rollings or locations. When this does happen, it is the usual practice to take the entire lot out of the main track and use it in minor service.

What Determines the Life of Rail?

By C. B. Bronson

Inspecting Engineer,
New York Central

THERE is a somewhat widespread belief that certain physical changes take place in rail steel during its service life, especially under heavy traffic, and that these changes become more apparent as the rail approaches the end of its service life. If this is true, it becomes important that we know what they are, what effect they have on the rail and what are the indications that the rail is approaching the end of its service life. This discussion will be limited to the life of the rail during its primary service, that is, in main-line service.

In the past, most of our main-line rail was not moved out of this service because of physical or structural impairment, but for economic reasons, usually because it had become out-classed by increased traffic and heavier wheel loads. This situation existed on nearly all important roads.

Changing Conditions

During the last few years the picture has been changing rapidly from one of larger purchases of new rail of the lighter sections to smaller purchases of heavier rails of better design and greater carrying capacity. Furthermore, economic practices have been developed with the purpose of prolonging the service life of rail. Included among these are the building up of rail ends by welding; heat treatment of the rail ends; changing joint bars to compensate for wear on the fishing surfaces; and other practices which influence the service life of the rail. In the past, the zone within the joint-bar area has always exerted a most important influence on the renewal of rail. Further stabilizing influences are acquired through the use of larger and more uniform ties, larger

tie plates, more ballast, improved methods of tamping and an improved roadbed sufficiently stable to withstand the traffic loads.

Development of Defects

If the rail is not sound physically in the beginning, as where internal shatter areas exist, there is a gradual fatiguing of the metal, which eventually results in progressive fracture, in the form of interior transverse fissures. Steel that is unsound because of segregation or allied causes, where the head breaks down progressively as a result of variations in the internal structure, falls in the same category. There are also seams in the base that may open up and cause half-moon fractures or even complete breaks; and web or fillet cracks or other flaws. With the exception of fissures, all of these defects present external evidence of their presence

Normal Wear

The second phase of the subject refers to the structural condition of the rail in its relation to service life. This includes the reduction in section of both high and low rails on curves, and the reduction of depth of the rail head on tangents. The stage of wear at which curve-worn rails should be removed is largely a matter of judgment, depending on the degree of curve, the speed of trains, the volume and type of traffic, as well as many factors related to the roadbed. In general, the high rail is allowed to wear until the wheel flanges contact

Modern Heavy Traffic With Heavier Wheel Loads Has Made Essential the Purchase of Larger Rail Sections



and development. Even today, the belief is still prevalent that steel crystalizes with age. "Old timers" persist in this belief and use the term frequently. It is an absolute impossibility for this to occur as a result of the service to which rail is subjected, and time and time again this has been shown to be a fallacy.

the splice bars. On the low rail, the degree of flattening and spreading of the head is the determining factor. If rail on tangents is worn considerably, it also tends to flatten out. In the past, head-worn rails on tangents have been the exception rather than the rule, because replacements were made long before this stage was reached.

In this phase, it can be determined with reasonable definiteness when rail is reaching the end of its service life.

Damage Factor

We might sum up the third phase of the subject in the term damage factor, and it seems to me that this factor outweighs all others in its effect on service life. Under this heading, to mention only a few, should be included driver-burned rails, those affected by corrosion, driver-kinked rails or the so-called surface-bent rails, corrugated rails, etc. In this phase also it is a matter of judgment as to when the cumulative damage has made the rail no longer suitable for main-line use.

With increasing train lengths, heavier wheel loads on both locomotives and cars, and higher speeds of operation, the damage effect seems to be increasing also. The so-called surface-bent rails can be kept in reasonable line and surface with proper roadbed conditions and track maintenance. If the ties are deteriorated, the ballast foul and the joints in poor condition, the ability to maintain reasonably satisfactory track is greatly lessened. Protective means to offset corrosion are available. Several of the other types of damage can be overcome partially, at least, through co-operation from the locomotive and car departments. As I see it, service life will be affected more by these factors than by either wear or physical breakdown of the steel.

The question as to what changes occur in rail with age are answered in general by the foregoing discussion. Curiously enough, all steels, including rail steel, improve with age, this being a well-known phenomenon in steel. On the other hand, the cold-rolling effect of the wheels introduces stresses in the head, which more than offset the favorable effect of aging, and causes a marked change in the distribution, as well as the magnitude of the stresses, through the head area. If they are of such magnitude as to come within the general range of the endurance limit, such stresses will cause rupture, as fissures, although in every case some unsoundness or other inducing cause is present, such as shatter cracks, segregation or other ingot defects.

Steel that is sound structurally and physically, which includes all but a negligible percentage of the total of all rails, can withstand the severe effects of service without impairment of its physical properties or micro-structure, throughout the life of the rail. The only part of the rail section affected by use is the narrow zone of cold-rolled metal at the uppermost

part of the head contour, which is affected both physically and with respect to the grain structure. This can be verified easily by breaking and examining the rail cross sections, particularly of rails from the low side of curves.

The whole matter may be summed up in the statement that age alone does not affect rail. There is one ex-

ception to this statement, however, this being that a minor percentage of rails that are physically weak or unsound to start with, will fail progressively under varying amounts of traffic. The volume of traffic necessary to cause failure is indeterminate, but, generally, the more traffic these rails carry, the greater the tendency to break down and fail.

C. & O. and N. & W. Announce Track Awards

DURING 1939 the practice of making annual track inspections for the purpose of rewarding local maintenance officers and section foremen for excellence in track maintenance was continued among a relatively small group of carriers. Among these roads are the Chesapeake & Ohio and the Norfolk & Western, and the results of the 1939 inspections on these two lines are given below.

Chesapeake & Ohio

On the Chesapeake & Ohio the annual track inspection was begun at Clifton Forge, Va., on the morning of October 30, and was completed at Gulf Switch, W. Va., on November 5, all main lines and the principal branch lines being covered. Continuing a practice of several years standing, the inspection was conducted from a special train consisting of office cars, Pullman sleeping cars, a dining car, and Roadway Inspection Car RI-1, which contains facilities for registering the condition of the track surface, cross level and alinement graphically.

Comprising the inspection party were the engineer maintenance of way and his staff and the division maintenance officers. In addition, the inspection party was accompanied over all or part of the system by the vice-president and general manager, the assistant general manager, the general superintendents and superintendents.

In grading the tracks for the inspection prizes, records provided by operation of the inspection car over the principal tracks of the railroad during March and July, 1939, were combined with those secured by operation of the car in the inspection train. Thus, in effect, the grading was based on conditions existing throughout the year rather than at the particular time

that the inspection train passed over the tracks.

To permit the different territories to be judged on a comparable basis, they were divided into five groups according to the character of the track and the class of traffic handled. This grouping was as follows: Group 1—double-track main lines, freight and passenger traffic; Group 2—single and double track main lines, principally freight traffic; Group 3—single track main lines, principally passenger traffic; Group 4—secondary branch lines; and Group 5—yard and terminal territories.

In Groups 1 and 2, prizes of \$50, \$40 and \$30 were awarded to supervisors receiving the first, second and third highest ratings, respectively, in each group, and in Groups 3, 4 and 5 prizes of \$50 and \$40 were awarded for the first and second highest ratings in each group. In addition prizes of \$50 each were awarded to two supervisors—one in Groups 1 and 2 and the other in Groups 3, 4 and 5—whose territories evidenced the greatest improvement as compared with the previous year. Prizes to section foremen took the form of \$25 and \$15 cash awards to those foremen having the best and second-best maintained sections on each supervisor's territory.

The names of the supervisors who won the prizes in each group are given in the following:

Group 1—First prize—J. H. Poin-dexter, Peninsula district, Richmond division; second prize—C. E. Butcher, Cincinnati district, Cincinnati division; third prize—H. G. Bowles, Charleston district, Huntington division.

Group 2—First prize—H. S. Chandler, Rivana district, Richmond division; second prize—J. F. Painter, James River district, Clifton Forge

division; third prize—O. C. Ewers. Paintsville district, Ashland division.

Group 3—First prize—G. E. Bostic, Mountain district, Clifton Forge division; second prize—C. L. Crummett, Piedmont district, Richmond division.

Group 4—First prize—D. F. Apple, New River Branch lines, Hinton division; second prize—J. A. Bragg, Cabin Creek district, Huntington division.

Group 5—First prize—H. S. Talman (assistant division engineer), Russell division; second prize—F. A. Dirnberg, Maumee district, Hocking division.

Award of the improvement prize

the Scioto division. Last year the Greggs Hill-Columbus district was awarded first place. Twenty-three of the 27 districts on the railroad attained higher ratings than in the previous year, while four were given the same ratings.

On the basis of the inspection, cash prizes for first, second, third and fourth places on the different districts were awarded to a total of 81 foremen. The awards included 21 first prizes, 24 second prizes and 18 third and fourth prizes. The highest rating among section foremen was attained by W. V. Crosby, Lockbourne, Ohio, whose territory was given the score of 9.49, one point above last

present time, therefore, we can only estimate that the service life of these mixture-treated ties will be somewhat greater than the expected average life indicated by the large group of 5-lb. straight creosote ties.

During the years 1909 to 1913, inclusive, we treated approximately 1,000,000 sawn Western pine ties with the creosote-petroleum mixture at our Albuquerque treating plant. During the years 1909-1911 this kind of tie was treated with 10 to 12 lb. of a mixture of 30 per cent creosote and 70 per cent petroleum; in the years 1912-1913 the treatment was a 7 lb. net retention of a 50/50 mixture. The percentage of renewals in these groups is, of course, much higher than in the mixture ties treated during the years 1923-1938. A few of the 1909-1911 and 1912-1913 mixture ties got into our test tie sections, and the record on these stands as shown in the foregoing table.

Although these ties were, in general, placed in dry climate locations, results to date are extremely favorable.

As previously stated, of the 60 million ties in track, about 45 million, or 75 per cent, are of our standard mixture treatment. The effect of this large percentage of mixture-treated ties in service is showing results in the way of lighter tie renewals on account of their longer life. While the creosoted ties on which we figure an expected average life of about 23 years did not have the full benefit of tie plate protection, the advantage of rail anchors and the better drainage and ballast conditions that we have today, they did not have to carry the present heavy high-speed wheel loads. Another factor that is going to affect our average life of ties in the future is the wider and longer 9-ft. tie. These are some of the factors that one has to take into account in forecasting the average life of treated ties, which makes such an estimate more or less of a guess, but in my judgment we have reached the point when we can expect an average life in excess of 25 years.

We are proud of the record we have made in extending the life of crossties, but we are not satisfied to stop here. We intend to continue research work to develop improvements in the treatment and care of ties. We are realizing large annual savings by the use of treated ties, but the cost of tie renewals is still one of the largest items of maintenance-of-way material expense. By extending the life of ties in track to a maximum, we are not only holding down this heavy maintenance expense, but are also conserving our timber resources.



Track Maintained by Section Foreman Reuben Rose on the Pocahontas Division of the N. & W., Who Made the Greatest Improvement in Track Rating in 1939

in Groups 1 and 2 was made to F. A. Sparks, supervisor of the Marion district of the Hocking division, while that for Groups 3, 4 and 5 went to C. F. Edwards, supervisor of the Columbus Terminal district of the Hocking division.

Norfolk & Western

On the Norfolk & Western the annual inspection revealed that in 1939 the tracks of this company reached the highest state of excellence in the history of the railroad. For the system as a whole the condition of the tracks was rated at 9.35, an improvement of five points as compared with 1938, this being the largest gain in track betterment for any year since 1934. A rating of 9.50 is the highest ever given.

Among the five divisions, the Scioto division was awarded first place with a rating of 9.41, while the Roanoke terminal, with a score of 9.39, took first place among the terminals. The greatest improvement among the divisions as compared with 1938 was made by the Pocahontas division, on which the rating increased 14 points to 9.35.

Among the roadmasters' districts, three divided first-place honors with a score of 9.43. These included the Clinch Valley line of the Pocahontas division, and the Greggs Hill-Columbus and Vera-Cincinnati districts of

year. Mr. Crosby has been a winner for five years. With scores of 9.48, three foremen tied for second place, namely, Ernal McCann, Sardinia, Ohio; Albert Lowe, Tacoma, Va.; and E. P. Combs, Rural Retreat, Va. Last year, Mr. Combs was one of two foremen who tied for second place. The greatest improvement among individual territories as compared with the previous year was attained by Reuben Ross, section foreman at Panther, W. Va., whose section gained six points to score 9.46.

What Can We Expect From Treated Ties?

(Continued from page 87)

have not included ties in our test tracks that have been treated with creosote-petroleum. The reason for this is that although we have treated some forty-five million ties with a creosote-petroleum mixture since this preservative was made standard in 1923, and we have more than 578,000 ties of this treatment in our tie tests, the latter show that only 1.5 per cent of about 550,000 inserted in the years 1923 to 1938, inclusive, to have been renewed and this percentage is too small to apply on the Forest Products Laboratory curve. At the



WHAT'S the Answer?

Anti-Creepers and Life of Rail

*What effect do anti-creepers have on the life of rail?
In what ways do they produce this effect?*

Controls Joint Gaps

By G. L. SITTON

Chief Engineer Maintenance of Way and Structures, Southern, Charlotte, N.C.

While anti-creepers are not used primarily to extend the life of rail, it is true that they do have some tendency to produce this effect. Rail that is properly spaced with respect to the expansion allowance and held where laid, will suffer less batter than rail that is not anchored, but which creeps until it is tight in some places and open in others. It may be contended that the effect of the reduction in batter is to decrease the cost of rail maintenance rather than to extend its life, because batter can be overcome by building up the rail ends. I believe it to be a fact, however, that rail that does not batter will actually outlast rail which batters and is built up at the ends, perhaps several times during its service life.

Rail life is not only shortened by excessive batter resulting from open joint gaps, but it is also shortened by excessive chipping when the joint gaps are closed completely. The tendency of anti-creepers is, therefore, to lengthen the life of rail because they prevent the joint gaps from closing permanently or from becoming too open. Probably the most important way in which anti-creepers tend to increase the life of rail is by reducing wear on the joint bars and on the fishing surfaces of the rail where they come in contact with the bars, by reason of better control of the joint gaps. Proper control of the joint gaps and the resulting reduction in the impact of the wheels as they cross these gaps, is an appreciable factor in re-

ducing the rate of wear on the joint bars and fishing surfaces. It should be noted in this connection that much of the rail that is anchored is not anchored sufficiently well to derive the benefits that have been mentioned.

There is one way in which anti-creepers may have a tendency to shorten the life of rail. This comes about through damage to the rail base by derailed wheels. Some types of anti-creepers are so designed that a derailed wheel will punch a slot in the rail base when it strikes the anchor, making it necessary to remove the rail from the track.

Use Justified

By L. L. ADAMS

Engineer Maintenance of Way, Louisville & Nashville, Louisville, Ky.

Primarily, the use of anti-creepers can be justified because they prevent the creepage of rail in long stretches, as a result of grade conditions and traffic. This causes the rail to become very tight at certain points, with wide joint openings at others. This creepage is generally more pronounced in cold weather, so that when the rail becomes hot under higher temperatures, there is always the danger of buckled track. Again, where the joints become wide open, there is danger

To Be Answered in April

1. *What precautions should be observed to avoid personal injuries when distributing material for rail renewals?*

2. *What are the relative advantages of wood, tile, brick, concrete and composition floors for small stations? For larger stations? Why?*

3. *When tamping by hand, should both sides or only one side of the tie be tamped? Why? Does the kind of ballast or the amount of raise make any difference?*

4. *What is the minimum depth to which it is safe to drive piles for trestle bents in material overlying rock? What alternatives can be adopted?*

5. *Should the renewal of rail in yards and the general surfacing of yard tracks be done by the regular yard gangs or by an extra gang? Why?*

6. *Can cracked pipes or badly leaking joints in a water line be repaired without shutting off the water? If not, why? If so, how?*

7. *Should ties be marked for renewals in the fall or spring? Why? How should they be marked? Who should mark them?*

8. *To what extent can bridge and building forces employ motor trucks advantageously? For what purposes? Are there disadvantages?*

that the bolts will break, creating a dangerous situation.

Ordinary anti-creepers will not prevent the normal movement of the rail in the joints as a result of the expansion of the individual rail. This expansion and contraction cause the joints to open when the rail is cold and close when it is warm. If the rail ends have not been hardened and beveled, there will be a flow of metal

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

into the gap when the joints are open. When they close as the temperature rises, this overflowing metal will often break back in the rail head, causing chipped rail ends. Before the practice of building up rail ends by welding in the track was adopted, many rails were removed from main tracks for this reason.

Where specially designed fastenings are in use that will anchor the rail positively at every tie against movement in either direction, the rail can be laid tight at normal temperature, and movement of the rail in the joints will be eliminated. Where this is done, the wear of the rail ends, on both the running and fishing surfaces, will be reduced. A section of track laid with 110-lb. rail and having fastenings of this type, carried approximately 150 million tons before it became necessary to build up the rail ends. By comparison, it was necessary to build up the rail ends on similar track that did not have this type of anchorage after the passage of 50 million tons. It can be assumed that the wear on the under side of the head was in proportion to that on the top.

If the rail is not anchored, the joints will open to a much greater extent, thereby increasing the joint wear. However, the matter of safety is of such importance that, while reduction in rail wear must be given consideration in selecting the type of fastening to be used for the prevention of creeping, it becomes a minor matter. Since the rail ends can now be built up in the track by welding, and since the wear on the fishing surfaces can be compensated for by the use of reformed crowned joint bars, I do not believe that the life of the rail will be increased materially through the use of anti-creepers. On the other hand, maintenance costs will be reduced, not only with respect to building up the rail ends, but in the matter of track labor for keeping the joints in line and surface.

Have Real Effect

By N. W. HUTCHINSON

Assistant Cost Engineer, Chesapeake & Ohio, Richmond, Va.

Although the life of rail depends more on other factors than proper anchorage, correctly-designed, correctly-applied and correctly-maintained anti-creepers have a positive effect in retarding rail wear. Primarily, the purpose of anti-creepers is to prevent longitudinal movement of the rail, which is usually created by the advancing movement of passing wheels. Failure to check this move-

ment ordinarily results in irregularities in line, surface, tie spacing, gage and joint gap.

Irregular line and gage create sudden lateral thrusts of the wheel flanges against the head of the rail, which, through intensified pressure, augment the rail wear that should take place normally. Irregular tie spacing and irregular surface subject the rail to unequal and possibly excessive stresses, causing surface-bent rail, the

correction of which is practically impossible. Repeated stresses in an improperly supported rail bring about premature fatigue and possible fracture.

Closure of the expansion gap between rail ends, resulting from creepage rather than expansion, makes inevitable the opening of the gaps between other rail ends. Excessive joint gaps accelerate the process of rail destruction caused by batter.

Interior Painting in Winter

*Should interior painting be done during the winter?
What are the advantages and disadvantages?*

Is Good Practice

By E. C. NEVILLE

Bridge and Building Master, Canadian National, Toronto, Ont.

It is generally considered good practice to do interior painting during the winter months when it is impracticable to do exterior painting because of weather conditions. This permits the preparation of an orderly painting program with the view of stabilizing the painting forces, even though it makes necessary the moving of some of the gangs over the same territory twice in the same year. This might appear to be a disadvantage, but when compared with the advantage of stable forces and the benefits of a well-balanced program, the back hauling of the gang is of small importance.

It must be admitted that, when painting interiors during the winter, it is not so easy to ventilate the rooms in which the work is being performed as it is in the summer, because low outside temperatures make it impracticable to open many windows, owing to the discomfort caused to the occupants. For this reason, when painting large offices it is sometimes more economical to do the work at night to avoid interference with the duties of the office staff. The same is true with respect to painting the waiting rooms of stations where many passengers are passing through the station during the day, to avoid interruption to the work and annoyance to patrons.

While exterior painting is primarily for the protection of the structure, interior painting is more largely for decorative purposes and cleanliness. For these reasons, the size and shape of the room should be considered when choosing the colors to be used, as well as the type of the decoration to be carried out. Large plain wall surfaces can be treated with striping

or with panels to break up the monotony of the appearance which a large flat area presents, with little additional cost. The trim for the door and window frames, moulding and other woodwork, should blend with the wall colors, since too much contrast is unpleasant. Stencils can often be used to advantage in breaking up large plain surfaces and thus add to the attractiveness of what would otherwise be bare-looking rooms.

Obviously, the selection of the materials should be made according to their economic value. Colors should be chosen that will not fade too quickly and that will stand several washings. Surfaces should be prepared properly before the paint is applied, and each coat should be brushed out thin and allowed to dry thoroughly before the succeeding coat is put on. It is almost axiomatic that if the best materials are used and the workmanship is of a high standard, the appearance will be far superior to jobs where the materials are mediocre and the workmanship is indifferent. Furthermore, less frequent painting will be required. Interior painting can generally be done in less time in the winter because of quicker drying.

A Matter of Economics

By L. G. BYRD

Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

This is largely a matter of economics, based partly on the advantages of a stabilized force and partly on the relative cost and the quality of the work. To determine the economic advantages, one must consider the method of heating employed. If the heat is provided by radiators, there is always some disadvantage in painting around and behind the radiators and

pipes, since it may be impractical to move them while the heat is needed. If the heat is furnished by stoves or through wall or floor registers, there will be no interference with the painters and no additional cost over summer painting.

As a rule, greater progress and, therefore, lower cost for the work, can be obtained during the winter than in the summer because the paint will dry more quickly in the dry air of a heated room, while there should be no bar to assurance of equal quality of workmanship. Another advantage is that interior painting can be carried to completion irrespective of the weather or temperature, and during any part of the season.

It is our practice to do as much of our interior painting as possible dur-

ing the winter, since this leaves the gangs free to do exterior work during the warmer seasons; this latter class of work must be suspended during cold or inclement weather. There is a disadvantage, however, in painting interiors during the winter because of the difficulty of providing sufficient ventilation to prevent the accumulation of fumes from the paints and oils. For this reason, painters doing interior work when low temperatures make adequate ventilation impracticable, should be required to wear respirators while at work. In this connection, many situations are likely to arise even during the summer where it is wise to use respirators and supervisory officers and foremen should be alert to require their use wherever conditions make this desirable.

fire-protection system at a dock, at a shop or at an important terminal where there is a large concentration of buildings and other facilities. Accurate up-to-date maps and records of fire protection systems should be kept at all times, for these facilities must of necessity be kept in such condition that there will be no possibility of their failure to function at any time. As a rule, if insurance is carried on any of these facilities, the underwriters will require that such maps and plans be maintained. Water-supply systems for general service at the more important mechanical and other terminals are usually segregated from the fire lines. In this case, the importance of maintaining an accurate record of the general system is as great as for that of the fire system, to avoid cross connections that might impair the effectiveness of both or either.

Again, prevention of waste through detection and repair of leaks in underground water lines make it desirable to maintain accurate plans of these lines. Where two or more independent systems are maintained, it is particularly important that cross connections be avoided, especially where there is a possibility of polluting the domestic or drinking-water supply. Records of underground lines can be maintained with little expense if changes and extensions are platted currently with the work. For example, when station maps are prepared or revised or where additional facilities are constructed, it requires but little time and expense to show these facilities, including the underground water lines on the map.

Mapping Water Lines

Where maps of water facilities are found to be incorrect or incomplete, to what extent are expenditures justified for tracing out underground pipe lines and connections to correct or complete the records?

In General, None

By E. M. GRIME

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

A lack of map records of water facilities complete and corrected up to date, is one of the many items of deferred maintenance which have accumulated in the recent years of decreased railway revenues. Sometimes a search of the files will disclose records of improvements made since the plant was constructed originally, and from this information it may be possible to complete the record. In fact, this should make it possible to bring the map up to date, provided the proper records were kept while the work was being done. It should be a part of the training of every engineer never to cover a pipe line, a connection, a valve or a fitting before a complete record of its location has been made in the construction notes.

In general, no expenditure is justified to locate underground pipe lines until some improvement is contemplated which makes it necessary to know the exact location of the lines. While it is an excellent thing to maintain a perfect record of all new construction, in some cases this cannot be justified in these times when every effort is directed to reducing expenses. While records, in themselves, pay no dividends, they may

save much valuable time for all concerned when plans are being prepared for new work.

Saves Larger Expense

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago

It is always important that maps and records of water facilities be correct and up to date, particularly those pertaining to underground pipe lines and connections, for these are hidden from visual observation. The piping arrangements at many wayside water stations are comparatively simple, for which reason they present no particular difficulty with reference to maintaining accurate records. On the other hand, the underground systems at shops and terminals may be quite complicated and thus present a far more difficult problem. Furthermore, where two or more independent systems are maintained, as for the general supply, for domestic use and for fire protection, the situation becomes still more complicated.

To what extent expenditures can be justified for recording these lines, especially when the existing maps are not complete, correct or up to date, depends on the importance of the several systems or the system as a whole, as for example an extensive

Surveys Are Cheaper

By J. S. EASTMAN

Special Water Inspector, Chicago, Milwaukee, St. Paul & Pacific, Chicago

I have in mind a point where there was considerable loss of head when pumping, with the result that the operation was quite expensive. Uncertainty as to the location of pipe connections throughout the distribution system made it practically impossible to determine where these losses were occurring, and the entire system was uncovered. As a result of this action, certain piping changes were made to correct the situation, and the cost of doing so was fully justified by the reduction in the cost of operation. At a second terminal, where new facilities were being constructed, extensive digging for abandoned pipe lines that were shown incorrectly on the drawings was fully justified by the savings developed

through putting these abandoned lines back into service.

In still another instance, a new storage tank and a rearrangement of the pipe lines for fire-protection purposes was required. An exhaustive survey which necessitated considerable excavation to locate the existing pipe lines became necessary before the plans for the new distribution system could be prepared.

In general, surveys and excava-

tions are much cheaper and better than the alternative of laying new lines promiscuously, although each case presents a problem that must be given individual consideration. To avoid future difficulties of this sort, great care should be taken to prepare accurate records for permanent files of all work concurrently with its construction. Carelessness in this respect can only result in future trouble and expense.

voids in the ballast and eventually to the surface to block drainage and create churning track. The remedy at this stage is to clean the ballast and apply enough new material to insure sufficient depth to distribute the loads uniformly. This is a situation that should be avoided, however, for applying additional ballast does not eliminate the depressions that have been formed and which may later develop into troublesome soft spots.

Since prevention is far better than cure, much money can be saved and much difficult maintenance can be avoided by installing a sufficient depth of ballast before the track is placed in service to insure a complete and uniform distribution of the loads to the subgrade. This can best be accomplished by first placing a layer, say 12 in. deep, of relatively fine material which, for best results, should be compacted by rolling, and then 8 to 12 in. of ballast, this depth depending on several factors, including the character and volume of traffic the track is to handle.

How Deep for Ballast?

What should be the minimum depth of ballast on high-speed, heavy-traffic lines? Why? Does the kind of ballast make any difference?

Is Mostly a Mat

By G. S. CRITES

Division Engineer, Baltimore & Ohio,
Punxsutawney, Pa.

Obviously, the purpose of ballast is to distribute the concentrated traffic loads to the subgrade uniformly; to provide good drainage for the track; and to hold the track firmly in position despite the lateral and longitudinal forces acting upon it. Where economically justified, ballast should fulfill all of these requirements under any conditions of traffic. Except for very coarse aggregates or for gravel containing large stones, the angle of repose of ballast is about 45 deg. For this reason, the proper depth of the ballast section is one-half of the distance between the centers of the ties, other than for large stones. Large stones will be pounded into the roadbed under high speed or dense traffic and do not, therefore, constitute ballast in the proper meaning of the term.

Any depth of ballast below the plane lying at a depth equal to one-half the distance between tie centers, may be considered as a supporting mat rather than an integral part of the ballast section, because below this plane there is no further distribution of the loads. A substantial mat of clean cinders, sand, good gravel or other suitable material is needed under high-speed, heavy-traffic lines, although a concrete slab or mat may be justified on a soft roadbed. Enough ballast should be placed on top of the mat to distribute the loads uniformly to it; at the same time this will provide sufficient material for surfacing the track and to hold it firmly in position.

Where very coarse aggregate of either crushed stone or slag, or where gravel with large stones in it, has been used for ballast the large pieces will

have been pounded into the roadbed and must be kept below the ballast section proper to prevent bumpy rough-riding track. Merely piling more large stone or gravel with boulders in it, on top of the old ballast to increase the so-called ballast depth, will place in disrepute all trackmen who are unfortunate enough to be assigned to the maintenance of the track so ballasted. The closer tie spacings that now prevail, compared with former standards, call for finer aggregates of crushed stone or hard slag than were often used in the past. Such ballast contains material that is too coarse to work economically or satisfactorily, or to function properly as ballast.

Foundation Most Important

By W. H. SPARKS

General Inspector of Track, Chesapeake &
Ohio, Russell, Ky.

To begin with, the foundation is the most important item of the track structure, taken as a whole. This includes the subgrade and the ballast, but for the purpose of this discussion it will be assumed that the subgrade is of suitable material, well drained and stable. Ballast performs three functions; that is, it provides drainage for the track, it resists both longitudinal and lateral movement in the track, and it distributes the concentrated wheel loads to the subgrade. An inadequate depth of ballast cannot distribute the traffic loads uniformly, so that in a relatively short time depressions will form in the subgrade immediately under the ties, which will retain water and tend to soften the roadbed.

As traffic passes, the softened material will be squeezed up through the

In years gone by, one of the most serious mistakes of construction engineers was their failure to apply a sufficient depth of ballast to insure a complete and uniform distribution of the traffic loads to the subgrade. As a matter of fact, this erroneous practice has not yet been fully eliminated, although most of the construction men of today are fully cognizant of the ill effects of too little ballast.

In recent years, the subgrade for a new track is built with a slight crown for drainage, but this purpose may be nullified by a light application of ballast, which results in depressions under the ties from which water cannot drain and from which seepage is too slow to keep the subgrade dry. The sensible thing to do is to preserve the surface of the roadbed without distortion, and thus assure satisfactory drainage. To do this, the depth of ballast must be sufficient to make a complete distribution of the traffic loads before they reach the subgrade. This depth will vary within limits, depending on the character and volume of traffic and in some cases on the kind of ballast.

If train service is infrequent and the speeds are low, 8 to 10 in. of locomotive cinders may be sufficient. As speed and traffic increase, the depth must be increased until a point is reached where this type of ballast is

A Construction Mistake

By L. A. RAPE

Track Foreman, Baltimore & Ohio,
Crothers, Pa.

inadequate, regardless of depth. When the traffic reaches the point where a better grade of ballast is demanded, the minimum depth should be 12 in., and this depth should also be increased with increases in traffic.

If coarse ballast, such as stone or slag, is to be used, it is better to apply a lower course of fine material to act

as a mat or cushion between the ballast and the subgrade, which should have a minimum depth of, say, 12 in. This should be of such a character that it will prevent any tendency for the subgrade material to work up into the ballast and foul it. In this case, it is desirable that the ballast itself have a depth of not less than 8 in.

designs. Methods of maintaining track scales have undergone radical changes in recent years because of the retrenchments the railways have been forced to make, and methods are now being followed successfully that would have been considered entirely inadequate only a few years ago. The section foreman makes a weekly inspection of rail gaps, anchorage and shields. He cleans the pit when necessary and reports water that may have accumulated because of a clogged drain or failure of an electrically driven sump pump.

A general inspection is made about every five months by a competent scale inspector, or oftener if there is any reason to expect derangements, at which time the scales are also tested with the scale-test car. Although there is a uniform inspection report form used by almost all of the roads in the jurisdiction of the Western Weighing and Inspection Bureau, our road is considered to be a "rebel," because we prefer, for reasons which we consider to be sufficient, to use the question type of report form. We believe that this form insures that no vital part of the scale will be overlooked. The answers to the questions are generally given by yes or no, although ample space is provided for suggestions and remarks on any point that needs elaboration.

Who Inspects Scales?

When inspecting scales, what details should be given attention? Who should make the inspection? What form of report should he make?

Also Includes Testing

By SCALE SUPERVISOR

In general, scale inspections are of little value, except where damage has occurred, unless they are accompanied by a weighing test since it is not possible to make adjustments otherwise. In the first place, scale maintenance is highly specialized and should not be assigned to any one but a competent scale man. The inspection should start at one end of the scale, that is, at the loaded end or the weighing end, and follow through the various levers and bearings progressively to the other end. Every pivot and bearing should be examined critically and its condition recorded before proceeding to the next point.

The condition of the live and dead rails is important, to determine whether they are anchored properly and have not crept and do not bind on the approach rails. Cleanliness is an important item in scale accuracy, as is drainage of the pit. Organizations on different roads differ so widely that about all that can be said on this point is that a complete report should be made to the inspector's superior officer, who should transmit it to the managing officer who handles matters relating to weighing.

Binds Cause Most Trouble

By C. R. EDWARDS

Supervisor of Scales and Work Equipment, Wabash, Decatur, Ill.

Scales are inspected to insure that they are being maintained in such condition that they will weigh accurately within the prescribed tolerance. An analysis of scale failures for any given territory will be likely to show that from 90 to 95 per cent of such failures are caused by binds. Binds occur most frequently between the

approach and weigh rails, the shields and the deck or the shields and the rail, depending on which member the shields are fastened to; and the chairs and the deck. Two other classes are check-rod binds and binds caused by derangement of the suspension members, the latter generally resulting from violations of the weighing and operating rules.

A modern scale of adequate capacity, that has been installed correctly, with ample clearance between live and dead parts and with the scale rails well anchored, will require inspection less frequently than scales of the older

Lubricating Switch Points

Is there any merit in the application of oil to the faces of switch points to reduce wear? If so, how should it be applied? If not, why? What alternate methods are practicable?

There May Be

By A. N. REECE

Chief Engineer, Kansas City Southern, Kansas City, Mo.

There is merit in the application of oil to the faces of switch points in some instances, provided a good grade of oil is used and it is applied daily. The application should be made with a 3-in. brush, and care should be exercised to keep the oil off the top of the point. If the oil is not applied daily, particularly at places where there is heavy switching, the oil will be wiped off and little will be gained by the application.

At points where locomotives start and stop frequently in switching, and where sand is used, the application of oil is detrimental, since it will tend to increase wear and I believe will offset any advantage that might accrue from

oiling the points. At such places, I prefer double stocking on the through stock rail to the use of the oil, or the use of switch-point protectors to reduce wear on the point.

Save Switch-Point Wear

By G. S. CRITES

Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

I am not in favor of applying oil to the faces of switch points, but other lubricants in the form of greases that have been prepared specially for this purpose save wear on the switch points when applied properly. Their use may be economical at important interlockings or at certain places in busy terminals, even when applied by hand with a swab where assigned men are available to do this. My objection to

the oil is that it does not have enough body to last, because it is wiped off quickly by the dry flanges.

There are several designs of mechanical rail-and-flange lubricators that can be installed at points where there is sufficient traffic through the turnouts to warrant their installation. The benefits of such appliances extend far beyond the particular switch point they are intended to protect, including a reduction in both rail and flange wear.

In some cases, switch-point protectors will serve all requirements; in others the same purpose can be accomplished by housing the point. The point on the outside of a curve can be set ahead of the opposite point and an inner switch-point guard installed. This scheme has the disadvantage, however, that the longer point protrudes beyond the front switch-rod clip. In such cases, I prefer to use a manganese switch-point guard of the type that bears against the tread of the wheels. At outlying points where greasing or guarding is out of the question, it may be economical to use manganese-tipped switch points on the turnout side. All of these methods have their places, but judgment must be exercised in their applications.

Lubrication Effective

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

In considering this subject, it must be kept in mind that switch points and rail on curves wear only through abrasion induced by the pressure of the wheel flanges against them, and that comparable wear occurs on these flanges. It is obvious, therefore, that a reduction in the wear on the switch point and turnout rails will be accompanied by a corresponding reduction in wheel-flange wear. For these reasons, I am in favor of lubrication at all points where the wear on the points and turnout rails is excessive.

To be effective, the lubricant must be present on the face of the point continuously; if it is not, most of the potential benefit will be lost. This raises the question as to how the application shall be made. At interlockings and junction points, the best way is to install a rail-and-flange lubricator. This is not always feasible in busy yards where the greatest amount of switch-point wear ordinarily occurs, primarily because switching engines generally use sand freely. In this case, hand application by means of a swab or brush is probably the best method. The application can be made several times daily by a man who per-

forms other duties in the intervals between applications. Once the rails are well coated with a suitable type of grease, it may be possible to make the applications less frequently.

Benefits Go Beyond Point

By J. L. MONK

Section Foreman, Southern Pacific, Tombstone, Ariz.

Much benefit may be derived from the application of oil to the faces of switch points, not only to eliminate

wear but to reduce curve resistance through the turnout, thus causing the turnout movements to be easier on the lead rails. Again, an oiled flange will cause less wear and tear on a spring-rail frog than a dry flange. Obviously, only those turnouts through which considerable traffic passes should be considered, and these should be selected only after careful study, for if this is not done the cost of applying the oil to some of the turnouts may be more than the depreciation of the points and turnout rails by reason of wear, especially for turnouts at isolated points.

Shimming a Timber Trestle

What is the maximum thickness of shims that should be permitted when surfacing timber trestles? Why? What is the alternative for a greater raise?

Would Use 2-in. Shims

By W. J. HOWSE

Bridge Foreman, New Orleans & North Eastern, Poplarville, Miss.

In these days of heavy wheel loads on both locomotives and cars and of increasing train speeds, I am convinced that shims in excess of 2 in. should not be used in surfacing timber trestles. What we ordinarily designate as shims are short lengths of thin wood of varying widths. These short pieces of wood exhibit a tendency to work out under vibration and movement of the timbers they support. For this reason, if a thickness of more than 2 in. is required, the inserted pieces should be long enough and wide enough to cover the entire length and width of the cap.

Any shim that is 1½ to 2 in. thick should be of the best pressure-resisting wood obtainable, and preferably as wide as the cap upon which it is to rest. Shims less than 1½ in. thick may be in two pieces, but when placed side by side they should cover the cap and be long enough to project beyond the stringers so that they can be nailed securely to the cap.

If a raise of more than 3 in. is required, say up to 8 in., it may be made safely by using timber blocking or sub-caps of the same length and width as the cap. However, I prefer to use temporary blocking and then cut the piles off enough to permit the use of a 12-in. cap, thus providing a double cap.

If the structure is of the framed-bent type, the foregoing method is satisfactory and can be used to advantage for bents 15 to 20 ft. high. For

shorter bents I prefer to change the posts to bring the bent to the proper height to carry the stringers and thus eliminate the use of shims. Any wood trestle that has been shimmed for any amount of raise or surfacing should be inspected frequently to insure that none of the shims are working loose, and that they are not failing in any manner, for such failure may endanger safety. In any event, it will mar the riding qualities of the track.

One and One-Half Inches

By L. G. BYRD

Supervisor of Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

When surfacing timber trestles to conform to a track raise, the shims should be limited to a thickness of 1½ in. If the required raise is greater, sub-caps should be used to insure a stiffer and more stable construction by tying the chords together and thus avoiding the working out of the bearings. If short shims thicker than 1½ in. are permitted, the vibration of the trestle during the passage of trains is likely to cause them to move a sufficient amount to work out, causing the track to become out of line and surface. Where sub-caps are used, they can be fastened securely to the caps and this situation will be avoided.

Where a raise of more than 1½ in. is required, it is our practice to use sub-caps of the same width as the cap and 10 ft. long, up to a thickness of 10 in. For a greater raise than this, the sub-cap is of the same length as the cap. Beyond a raise of 1 ft. the inserted material becomes more than

a shim or sub-cap, and special plans are prepared to cover the work. Shims are generally fastened to the caps by nails, while we use boat spikes or bolts to anchor sub-caps.

Several Factors Involved

By GENERAL INSPECTOR OF BRIDGES

Almost any pile or timber bent will settle some, depending on the character of the soil, the penetration of the piles and other local factors. If the settlement takes place slowly, it is satisfactory to insert shims but as settlement progresses they should be withdrawn and thicker shims substituted. It is not good practice to pile thin shims on top of each other. The thickness of the shims should be limited to 1½ or 2 in., depending on

whether the structure is on curve or tangent and whether the bents are rigid or have some movement. Sometimes one end of a bent will settle more than the other, but where this can be done a plank of the same width and length of the cap should be inserted if the settlement exceeds 2 in.

If settlement continues, something else should be done. Continued or excessive settlement generally indicates insufficient penetration of the piles and it may be desirable to drive a new bent to secure greater penetration. In some cases thicker plank shims can be inserted from time to time in conjunction with the shorter shims until sufficient settlement has taken place to warrant cutting off the piles and placing a double cap. Whether the shims are long or short, they should be fastened securely to the cap and be as wide as the cap.

when approaching persons on or near the track, extra care should be exercised, as they may be muffled in such a way as to interfere with their hearing the approach of the car. If the rail is at all slippery, the speed at which the car is operated should be reduced, so that at all times it can be stopped within the distance which is seen and known to be clear.

Be Prepared to Stop

By L. A. RAPE

Track Foreman, Baltimore & Ohio,
Crothers, Pa.

I think that the most important precaution connected with the winter operation of a motor car is that one should always be prepared to stop. This is important at any season, but is particularly so in the winter. Rails are often icy or frosted, or at least wet during the winter, so that a greater distance is required for the stopping of the car. A sharper lookout should be maintained, especially during gloomy or very cold weather, and dependence should never be placed in others to hear the approach of the car. Persons working or walking on or alongside the track may be so bundled up that they do not hear or distinguish sounds readily, while the snow also tends to deaden sounds, especially through the rails.

Batteries should be stronger and given special care during the winter to insure a dependable spark. Brakes are not as effective when the rail is wet or frosty as when it is dry, for which reason the operator should know at all times that they are as nearly perfect mechanically as they can be made. An item that is sometimes not given the attention its importance deserves is that of lubrication. Special attention should be given to lubrication, because oils stiffen and greases harden as the temperature decreases, and bearings can run dry even when it is supposed that they have been given the proper dosage of lubricant.

While motor-car engines are supposed to be immune to damage by reason of the freezing of the water in the cooling system, this does not always work out this way. Therefore, it is desirable to use an anti-freeze solution in the cooling system. If this is not done, the water should be drained at night and the system should be filled with hot water, if this is obtainable, in the morning. If the car is to be set off alongside the track for a considerable period during very cold days, some means should be provided for keeping the engine warm during its period of inactivity.

Motor Cars in Winter

What special precautions should be observed in the operation of motor cars during the winter that are not necessary in warm weather?

Must Be in Good Condition

By H. R. CLARKE

Engineer Maintenance of Way, Chicago,
Burlington & Quincy, Chicago

Two principal precautions should be observed in connection with motor car operation during the winter; these being (1) to have the car in the best possible condition, even better than for summer operation; and (2) to operate it with greater care. Operating conditions during the winter are difficult, for which reason the car should be kept in the best possible condition. Batteries should be maintained so that a good hot spark will be delivered; all wiring should be in good shape; and brakes should be given careful attention so that the operator knows that they are in first class condition. If the engine is water-cooled, as most of them are, and if an anti-freeze solution is not used, it is desirable that the water be drained from the cooling system every evening. If possible, this should be replaced with hot water in the morning, since this will make the starting of the motor a little easier. Most motor car engines are so designed that even if the water freezes it will do no damage, but draining will certainly do no harm.

The motor car should be equipped with a simple, inexpensive, wind shield which will afford the men on the car reasonable protection. As a

rule, a canvas, supported on a suitable frame and held at the correct height across the front of the car is sufficient for the ordinary gang car, on which long trips are not made. Cars that are used by signal maintainers, track patrolmen, supervisors or others to make long trips daily, should have a more elaborate wind shield which will provide better protection. In no case, however, should the wind shield be of such a design as to interfere with the view of the operator of the car or in any way impede the movements of the men on the car if it should become necessary for them to unload quickly.

Flagging equipment, especially lanterns, should be looked after more carefully in winter than in summer, since the working day is shorter and there is greater likelihood that they will be required. This also applies to flags, which should be clean and bright in color, since it is more difficult to distinguish the flags in foggy or gloomy weather than under more favorable weather conditions. Furthermore, unfavorable days of this sort occur more frequently during the winter than at other seasons.

Even greater care should be exercised in the operation of the car during the winter than in the summer, especially when approaching road crossings, because drivers of motor vehicles on the highway may not be as alert as in warm weather. Again,



NEWS

of the Month

Bill to Make Train Wrecking a Federal Offense

Representative Walter of Pennsylvania has introduced a bill in the House of Representatives which would make it a crime against the federal government to wreck or attempt to wreck a train engaged in interstate commerce. The bill provides the death penalty or imprisonment for life in the event of a wreck causing the death of any person and in other cases a maximum fine of \$10,000 or 20 years imprisonment or both.

President Re-appoints Commissioner Miller

On January 25, President Roosevelt sent the name of Interstate Commerce Commissioner Carroll Miller to the Senate for confirmation for re-appointment on the Interstate Commerce Commission for a term ending December 31, 1946. Commissioner Miller's present term expired December 31, 1939, but he continued to serve under a provision of the law, which permits a commissioner to remain in office until he is re-appointed or his successor qualifies.

C. & E. I. First Road Out of Section 77

On January 10, when the district court at Chicago signed an order confirming the plan of reorganization, the Chicago and Eastern Illinois became the first major railroad to emerge from bankruptcy under Section 77 of the Bankruptcy Act. The order approves the creation of a reorganization committee which will select directors, exchange securities, prepare new by-laws and set up a new charter. When these details are completed the property will be turned over to the new management.

I.C.C. Authorizes Railroads To Meet Truck Competition

The Interstate Commerce Commission has authorized railroads serving specified areas in Iowa, Missouri, Kansas, Nebraska, Colorado, Wyoming and South Dakota to meet the competition of itinerant truckers with rate reductions on wheat, corn, oats and barley, and certain of their products. The report of the commission stated "The price paid by the itinerant trucker at country origins ranges from one cent to five cents per bushel, and averages about three cents per bushel, higher than the price paid for shipments by rail, which is basically the government market price minus

the rail rate to the market . . . The proposed rates reflect reductions . . . which would have the effect of about equalizing the truck and rail price.

Railroads Speed Up Chicago-Twin Cities Service

On January 28, the Zephyrs of the Chicago, Burlington & Quincy, the Hiawathas of the Chicago, Milwaukee, St. Paul & Pacific and the "400's" of the Chicago & North Western began operation on new schedules that reduced the running time of these streamliners between Chicago and St. Paul, Minn., and Minneapolis by fifteen minutes. The fastest schedule of these trains is that of the Morning Zephyr of the Burlington, which now makes the run from Chicago to St. Paul, a distance of 431 miles, in six hours. A number of other schedules were reduced from 6½ hr. to 6¼ hr. between these two cities.

Protective War-Time Measures For British Transportation

In a speech recently delivered to British citizens over a nation-wide radio hook-up, Euan Wallace, British Minister of Transport, described some of the precautionary measures that have been taken to meet the threat of mass attacks from the air on docks, railways, bridges and important highway junctions. In many parts of the country, fill material from quarries and slag heaps has been dumped at strategic points for repair purposes. Bridge parts specially designed to be interchangeable for varying spans, and capable of very rapid erection, have been stocked at suitable points and men have been trained to assemble them at a fast pace. Although car lights have recently been permitted again on trains, so that the passengers may read, the lights are equipped with an emergency switch whereby they may be turned off immediately by the train guard.

December Operating Revenues 8.4 Per Cent More Than 1938

According to the Association of American Railroads on January 16, preliminary reports from 92 Class I railroads, representing 82.6 per cent of the total operating revenues, show that those roads in December, 1939, had estimated operating revenues amounting to \$285,027,826, compared with \$262,881,600 in December, 1938, and \$310,340,618 in the same month of 1930. The December gross was 8.4 per cent above that for December, 1938, but 8.2 per cent

below that of December, 1930. Freight revenues of those roads in December, 1939, amounted to \$227,305,611, or 10.3 per cent above and 1.7 per cent below the same month in 1938 and 1930, respectively. Passenger revenues in December, 1939, totaled \$32,056,484, or 1.5 per cent and 31.9 per cent below the corresponding month in 1938 and 1930 respectively.

South-North Rate Reductions Postponed

The effective date of the rate reductions in the Southern Governor's rate case, in which the Interstate Commerce Commission ruled in favor of the South, as described in the January issue, has been postponed by the Interstate Commerce Commission from March 1 to April 1. The commission had received a number of petitions for a postponement and a rehearing, including petitions from the Northern railroads and the states of Illinois, Indiana, Michigan, Ohio and Wisconsin. The latter petition was based principally on the ground that the Commission had developed insufficient data to show the relative costs of handling freight in the South and claimed "that the Commission has prescribed rates and relationships based not primarily upon appropriate rate making factors but really, rather, upon the economic effects which the prescriptions are calculated and expected to produce, a consideration which is without justification in law."

I.C.C. Censures Railroads For Denver Produce Terminals

In a report submitted by Commissioner Porter in an investigation instituted by the Interstate Commerce Commission on its own motion into the construction and operation of two competitive produce terminals at Denver, Colo.—one by the Union Pacific and the other jointly by the Chicago, Burlington & Quincy, the Colorado & Southern, the Denver & Rio Grande Western, the Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific—the commission asserts there is "unnecessary duplication of produce terminals" at Denver, resulting from "uneconomical and inefficient management due to lack of sufficient co-operation between respondent railroads." The report adds "the City of Denver had no need for more than one produce terminal, and that a joint terminal served by all roads would have been preferable—the public interest in a healthy transportation system demands that the future be made secure against such practices."

Personal Mention

General

F. J. Liston, roadmaster on the Canadian Pacific at Montreal, Que., has been promoted to acting assistant superintendent.

John P. Kiley, engineering assistant in the office of the chief financial officer of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed special representative of the chief operating officer, with headquarters as before at Chicago. Mr. Kiley was born in Chicago on August



John P. Kiley

13, 1895, and graduated in civil engineering from Villanova College at Villanova, Pa., in 1915. He entered railway service in June, 1915, in the engineering department of the Milwaukee, where he was engaged on track elevation work and was later assigned to federal valuation work. In 1930, he was appointed engineering assistant in the office of the chief financial officer at Chicago and held that position until his recent promotion.

Kenneth Louis Moriarty, assistant superintendent on the Denver & Rio Grande Western at Grand Junction, Colo., and an engineer by training and experience, has been promoted to division superintendent, with the same headquarters. Mr. Moriarty was born at Joliet, Ill., on November 18, 1896, and entered railway service in December, 1917, in the engineering department of the Chicago Great Western, later being promoted through various positions to assistant engineer in the maintenance of way department. In 1924, he went with the D. & R. G. W. as a division engineer, with headquarters at Gunnison, Colo., and after serving in this capacity at various points, was appointed roadmaster at Green River, Utah, in 1933. Two years later Mr. Moriarty was promoted to trainmaster at Glenwood Springs, Colo., and on November 10, 1938, he was advanced to assistant superintendent at Grand Junction, holding the latter position until his recent appointment, which was effective November 16.

Walter W. Greenland, Jr., superintendent of the Moberly division of the Wabash, with headquarters at Moberly, Mo.,

and an engineer by training and experience, retired on January 1. Mr. Greenland was born at Clarion, Pa., on January 8, 1874, and graduated in civil engineering from Pennsylvania State College in 1896. He entered railway service in 1897 as a rodman for the Union Railroad and the Carnegie Steel Company, later becoming levelman, transitman and inspector of bridges. In 1900, he went with the Pennsylvania as a draftsman and inspector on the Lines West of Pittsburgh, and a year later he went with the Wabash as a transitman at Decatur, Ill. In 1902, he was promoted to resident engineer at Moberly, Mo., and in December, 1904, he returned to Decatur as assistant engineer. He later served successively as engineer of maintenance of way, assistant engineer and division superintendent at Moberly until April, 1929, when he was advanced to general superintendent of the Western district, with headquarters at St. Louis, Mo. On August 15, 1930, that position was abolished, and Mr. Greenland returned to Moberly as division superintendent.

Albert W. Hervin, trainmaster of the Rocky-Mountain division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Butte, Mont., and an engineer by training and experience, has been promoted to superintendent of the Trans-Missouri division, with headquarters at Miles City, Mont. Mr. Hervin was born at St. Paul, Minn., on October 20, 1895, and graduated in civil engineering from the University of Washington. He entered railway service on June 5, 1911, as a chainman on the Great Northern at Minot, N.D., later being promoted successively to tapeman, rodman, inspector of concrete and timber construction and inspector of snow shed construction. In February, 1919, he was appointed assist-



Albert W. Hervin

ant roadmaster at Tye, Wash., and on May 20, 1919, he went with the Milwaukee as instrumentman at Butte, Mont. After service as a roadmaster for a short time Mr. Hervin was promoted to assistant engineer at Spokane, Wash., on February 1, 1923, and on May 25, 1925, he was appointed roadmaster at Malden, Wash. On September 1, 1926, he was transferred to Three Forks, Mont., and two months later he was promoted to roadmaster and trainmaster on the C. M. & G. (a subsidiary of the Milwaukee),

with headquarters at Joliet, Ill. On May 1, 1927, he was appointed trainmaster on the C. & M. division and later served as trainmaster on the Chicago Terminals, the Superior division, the Trans-Missouri division and the Rocky Mountain divisions with headquarters at Butte, Mont., where he was located until his promotion on January 1.

Engineering

W. Paul Sullivan, chief clerk to the chief engineer of the Chicago, Indianapolis & Louisville (Monon), has been appointed assistant to the chief engineer, with headquarters as before at LaFayette, Ind., a newly created position.

Roy A. Brown, acting division engineer on the Chicago, Rock Island & Pacific, with headquarters at Fairbury, Neb., has been promoted to division engineer at that point, succeeding **E. F. Mason**, who retired on January 1 because of ill health.

Charles O. Coverly, architectural draftsman for the Atchison, Topeka & Santa Fe, has been promoted to architect, with headquarters as before at Chicago, succeeding to the duties of **Edward A. Harrison**, whose retirement on January 1 was announced in the January issue.

C. H. Hardwick, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has been promoted to district maintenance engineer, with the same headquarters, succeeding **Mason Rector**, who resigned effective February 1.

Chester B. Clegg, water service and heating engineer of the Western lines of the Atchison, Topeka & Santa Fe, has been promoted to assistant engineer, with headquarters as before at Amarillo, Tex. Mr. Clegg will continue with his former duties as water service and heating engineer on the Western lines in addition to such other duties as may be assigned to him.

Vicente Espinosa Palomero, division engineer of the Southeastern division of the National Railways of Mexico, with headquarters at Tierra Blanca, Vera Cruz, Mex., has been transferred to the Puebla division, with headquarters at Puebla, Pue., Mex., succeeding **Pablo Luna Enriquez**, who has been transferred to the Jalapa division, with headquarters at Jalapa, Vera Cruz, Mex., replacing **Federico Fischer Ibanez**. Mr. Ibanez, in turn, has been transferred to the Southeastern division, with headquarters at Tierra Blanca, relieving Mr. Palomero.

Oscar S. Bowen, whose retirement on January 1, as assistant to the chief engineer of the Great Northern, with headquarters at St. Paul, Minn., was announced in the January issue, was born in Missouri in 1867, and entered railway service in 1887, as a draftsman for the Coeur d'Alene & Pend D'Oreille (now leased by the Spokane International) in Washington, later working for several other lines in that state, some of which later became a part of the Great Northern. Mr. Bowen later became chief draftsman for the United States Surveyor General in the state of Washington and

for a few years engaged in private business in Spokane, Wash. In 1901, he returned to railroad service as office engineer for the Great Northern at Spokane and was advanced to district engineer at that point, later being transferred to Seattle, Wash. Mr. Bowen was appointed assistant to the chief engineer, with headquarters at Seattle in 1913, and in 1924, he was transferred to St. Paul, where he remained until his retirement.

R. C. Miller, general superintendent of the Eastern Ohio division of the Pennsylvania, with headquarters at Pittsburgh,



R. C. Miller

Pa., has been promoted to assistant chief engineer of the road with headquarters at Philadelphia, Pa., and with jurisdiction over the entire system, effective January 16. Mr. Miller was born in Zanesville, Ohio, in 1878 and was graduated from Ohio State University in 1901. While at college he worked during the summer vacations as an assistant on the Zanesville division engineering corps. Entering the permanent service of the railroad as an engineering corps assistant at Pittsburgh in 1901, Mr. Miller subsequently served in engineering posts on the Indianapolis, Marietta, Logansport, Toledo, St. Louis, Chicago Terminal, Philadelphia and New York divisions. He was advanced to superintendent of the Schuylkill division in 1926 and subsequently headed the Toledo and Columbus divisions. During parts of 1929 and 1930 he was acting assistant chief engineer, with headquarters at Philadelphia, and was then appointed general superintendent of the Southwestern division at Indianapolis. He was promoted to general superintendent of the Eastern Ohio division on November 1, 1931.

K. Huffman has been appointed engineer of construction of the Central region of the Canadian National, with headquarters at Toronto, Ont., to succeed **R. A. Baldwin**, who retired on January 10. Mr. Baldwin was born in Ottawa, Ont., on January 10, 1875, and entered railway service in March, 1899, as a draftsman in the engineering department of the Grand Trunk (now part of the Canadian National) at Toronto. In September, 1900, he was employed as a transitman and draftsman on the construction of the Algoma Central (now the Algoma Central & Hudson Bay) at Sault Ste. Marie, Ont., and

one year later he went with the New York Central as a transitman at Buffalo, N.Y. In April, 1904, he went with the Wabash as chief draftsman at St. Louis, Mo., and five months later he returned to Canada to become chief draftsman of the Canadian Northern (now part of the Canadian National) at Toronto. Mr. Baldwin was later appointed assistant engineer and division engineer. In July, 1914, he was promoted to engineer of maintenance of way of the Ontario Grand division of the Canadian Northern, Eastern lines, with headquarters at Toronto, and later was appointed engineer of maintenance of way of the Eastern lines, with the same headquarters. In the spring of 1917, he was appointed assistant engineer and later became assistant engineer on the Lines East of Port Arthur and O'Brien of the Canadian National and in January, 1921, he was promoted to engineer of construction, the position he held until his retirement.

Charles E. Sloan, assistant engineer of bridges of the Baltimore & Ohio, with headquarters at Baltimore, Md., has been appointed engineer of bridges, with the same headquarters, succeeding **P. G. Lang, Jr.**, whose death was noted in the January issue. Mr. Sloan was born at Lewisville, Ohio, on February 7, 1885, and attended the public schools of West Virginia. He



Charles E. Sloan

was graduated from West Virginia University, Morgantown, and attended Johns-Hopkins University, Baltimore. In 1911 Mr. Sloan entered the service of the Buckhannon & Northern (Monongahela) as a draftsman. On January 1, 1913, he joined the Baltimore & Ohio in a similar capacity. He was advanced to chief bridge draftsman on August 1, 1918, and on March 1, 1923, was appointed assistant engineer of bridges, which position he held until his recent appointment as engineer of bridges.

Henry S. Loeffler, whose promotion to assistant chief engineer of the Great Northern, with headquarters at St. Paul, Minn., as announced in the January issue, was born in Rock County, Minn., on August 24, 1889, and graduated in civil and electrical engineering at the University of Minnesota in 1915. He entered railway service on April 3, 1915, as a bridge inspector on the Northern Pacific, later serving as a laboratory assistant at the University of Minnesota. In

October, 1915, he returned to railway service as an assistant engineer on the Great Northern, serving in that position and as a draftsman until March, 1918, when he became an assistant engineer in war service, with the United States Emergency Fleet Corporation. He returned to railway service on April 11,



Henry S. Loeffler

1919, as an assistant engineer on the Great Northern. Mr. Loeffler was promoted to bridge engineer on February 25, 1929, with headquarters at St. Paul, and held that position until his promotion to assistant chief engineer on January 1, 1940.

George V. Guerin, Jr., whose promotion to bridge engineer of the Great Northern, with headquarters at St. Paul, Minn., was announced in the January issue, was born at St. Paul on June 17, 1902, and graduated in civil engineering from the University of Minnesota in 1924. He entered railway service on June 11, 1924, as a draftsman in the bridge department of the Great Northern, and on October 1, 1926, he was promoted to inspector, serving in that capacity and as a draftsman and inspector until February 25, 1929, when he was promoted to assistant bridge



George V. Guerin, Jr.

engineer, with headquarters at St. Paul, the position he held until his promotion to bridge engineer, effective January 1.

Arthur B. Hillman, whose promotion to engineer maintenance of way of the Chi-

cago & Western Indiana and the Belt Railway Company of Chicago, with headquarters at Chicago, was announced in the January issue, was born in Chicago on September 24, 1889, and attended the University of Illinois in 1913 and 1914. He entered railway service in September, 1909, as a chainman on the Lake Shore & Michigan Southern (now part of the New York Central System), later being promoted to rodman. In September, 1911, he went with the Chicago & Western Indiana as a rodman and served in that capacity until 1914, except for the period when he attended the University of Illinois, later being promoted successively to levelman and transitman. In October, 1916, he went with the Belt Railway as assistant engineer, maintenance. During the war he served as a first lieutenant and a captain in the U. S. Army, and returned to his former position as assistant engineer in April, 1919. Mr. Hillman was appointed roadmaster in March, 1925, and in November, 1927, he was promoted to assistant trainmaster. In March, 1929, he was again appointed assistant engineer, maintenance and in December, 1930, he was appointed roadmaster. From July,



Arthur B. Hillman

1937, to December, 1938, he served also as assistant engineer in charge of the reconstruction of Clearing Yard, at the same time continuing his duties as roadmaster, with jurisdiction over the bridge and building department. Mr. Hillman was roadmaster in charge of the track and bridge and building departments of the Belt Railway at the time of his promotion, which was effective January 1.

A. H. Stimson, supervisor of track on the Pittsburgh division of the Pennsylvania, with headquarters at Derry, Pa., has been promoted to division engineer of the Monongahela division, with headquarters at Pittsburgh, Pa., succeeding **D. E. Rudisill**, who has been transferred to the St. Louis division, with headquarters at Terre Haute, Ind. Mr. Rudisill relieves **J. B. Jones**, whose promotion to assistant superintendent of freight transportation on the Central region, with headquarters at Pittsburgh, is announced elsewhere in these columns.

R. L. Schmid, principal assistant engineer of the Nashville, Chattanooga & St. Louis, has been promoted to chief engineer, with headquarters as before at

Nashville, Tenn., succeeding **George F. Blackie**, who retired on January 1. Mr. Schmid was born at Louisville, Ky., on March 20, 1886, and attended the College of Engineering of Kentucky State University from 1907 to 1910. He entered railway service in February, 1906, as a



R. L. Schmid

rodman on the Louisville & Nashville. He served in the engineering department of the Penn Tunnel and Terminal Railroad in 1909, returning to the engineering department of the L. & N. in 1910. He entered the service of the Nashville, Chattanooga & St. Louis in 1915 as a pilot on valuation work, and was promoted to resident engineer on construction in 1916. Mr. Schmid was promoted to assistant engineer, with special assignments in 1918, and to assistant division engineer of the Chattanooga division in 1919. He was advanced to division engineer of the Atlanta division in 1920, and in January, 1926, he was promoted to assistant to the general manager, with headquarters at Nashville. In September, 1939, he was appointed principal assistant engineer, with headquarters as before at Nashville, Tenn., and held that position until his promotion to chief engineer.

Track

L. H. Wohlert, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific at Terre Haute, Ind., has been transferred to LaCrosse, Wis., succeeding **Leo Cross**, who has been transferred to Terre Haute, replacing Mr. Wohlert.

C. L. Conley has been appointed acting roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Syracuse, Kan., replacing **R. C. Mathews**, who has been transferred to La Junta, Colo. Mr. Mathews relieves **R. E. Knapp**, who has been assigned to other duties.

F. B. Noonan, a rodman in the engineering department of the Illinois Central at Champaign, Ill., has been promoted to track supervisor, with headquarters at Olney, Ill., succeeding **W. S. Williams**, who has been transferred to Palestine, Ill. Mr. Williams replaces **T. J. Flynn**, who retired on January 1.

J. Pickrel, track supervisor on the Chicago, Burlington & Quincy at York, Neb., has been promoted to roadmaster at Curtis, Neb., succeeding **H. C. Arnold**, who

has been transferred to Ferry, Neb. Mr. Arnold relieves **K. W. Eustace**, who has been transferred to Sterling, Colo., replacing **James Toohey**, who retired on January 1.

W. F. March, assistant roadmaster on the Chicago, Rock Island & Pacific at Rock Island, Ill., has been promoted to roadmaster at Washington, Iowa, succeeding **Ed Sullivan**, who retired on January 1, and **C. F. Schwank**, track supervisor at Rock Island, has been advanced to assistant roadmaster at that point, replacing Mr. March.

J. P. Hiltz, Jr., assistant supervisor of track on the Pennsylvania, with headquarters at Trenton, N.J., has been promoted to supervisor of track on the Philadelphia division, with headquarters at Enola, Pa., effective January 16. **W. A. Thomson**, a track foreman, has been advanced to assistant supervisor of track at Trenton to replace Mr. Hiltz.

George William Parker, whose retirement on November 30, as track supervisor on the Illinois Central at Waterloo, Iowa, was announced in the December issue, was born at Colesburg, Iowa, on September 20, 1874, and entered railway service on March 28, 1897, as a section laborer on the Illinois Central. He was promoted to section foreman in August, 1900, and in November 26, 1919, he was advanced to track supervisor at Waterloo, Iowa, where he remained until his retirement.

A. L. Lechner, section foreman on the Minneapolis & St. Louis at Gifford, Iowa, has been promoted to track supervisor, with headquarters at Fort Dodge, Iowa, succeeding **H. E. Herington**, who has been transferred to Watertown, S. D., replacing **John Factor**, who has retired.

Mr. Factor entered railway service as a section laborer on the M. & St. L. in 1886, and was promoted to section foreman in July, 1908. He was further advanced to track supervisor at Watertown on August 10, 1917, the position he held until his retirement.

Grover C. Modglin, whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Tacoma, Wash., was announced in the December issue, was born at Mahanda, Ill., on January 19, 1896. He entered railway service on July 12, 1912, on the Illinois Central and on March 10, 1917, he left railway service to enter other employment. He returned to railroad work on June 6, 1926, as a section foreman on the C. & M. division of the Milwaukee and was promoted to extra gang foreman a year later. Mr. Modglin served as section foreman and extra gang foreman until his recent promotion.

Albert A. Witter, whose promotion to track supervisor on the Illinois Central, with headquarters at Council Bluffs, Iowa, was announced in the December issue, was born at Newell, Iowa, on April 15, 1900, and entered railway service on November 18, 1918, as a trackman on the Illinois Central. On December 16, 1919, he was promoted to assistant section foreman and assistant extra gang foreman and on January 1, 1924, he was advanced

to section foreman. Mr. Witter was promoted to extra gang foreman on April 25, 1935, and served in that capacity and as section foreman at Newell until his recent promotion.

R. J. Pierce, general foreman on the Erie at Buffalo, N. Y., has been promoted to track supervisor of Subdivision No. 1 of the New York, Susquehanna & Western (controlled by the Erie), with headquarters at Paterson, N. J., to succeed **J. J. Joyce**, who has been transferred to Subdivision No. 2 of the N. Y. S. & W., with headquarters at Butler, N. J. Mr. Joyce replaces **Arthur Price**, who has been transferred to the New York Terminal division of the Erie, at Jersey City, to succeed **C. J. McNamara**, whose death is noted elsewhere in these columns.

Leonard Sears, whose promotion to roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Guthrie, Okla., was announced in the December issue, was born at Guthrie on October 2, 1901, and entered railway service on November 1, 1923, as a section laborer on the Santa Fe at Lawrie. On May 25, 1926, he was promoted to student foreman and in March, 1927, he was advanced to assistant extra gang foreman. Mr. Sears was promoted to section foreman on May 5, 1929, and from 1931 to 1937 worked in extra gang service, returning to the position of section foreman in April, 1937. He was section foreman at Lawrie, Okla., at the time of his recent promotion.

Leslie H. Dahl, whose promotion to roadmaster on the Northern Pacific at Fargo, N. D., was announced in the December issue, was born in London, England, on August 11, 1913, and graduated in civil engineering from the Polytechnic Institute of Brooklyn, N. Y., in 1935. He entered railway service on September 1, 1936, as a track apprentice on the St. Paul division of the Great Northern, and in January, 1937, he was transferred to the Lake Superior division. Mr. Dahl was promoted to assistant bridge and building supervisor on the Yellowstone division in December, 1937, the position he held at the time of his recent promotion, which was effective November 1.

J. P. Zearley, supervisor of track on the Pennsylvania at Carnegie, Pa., has been transferred to Richmond, Ind., succeeding **Delphi Lewis**, who retired on January 1. Mr. Lewis entered railway service as a track laborer on the Pennsylvania at Plain City, Ohio, on July 2, 1901, and on April 1, 1906, he was promoted to extra gang foreman at Cable, Ohio. On November 16, 1908, he was transferred to Milford Center, Ohio, as a track foreman and remained there until March 1, 1917, when he was promoted to general foreman on subdivision No. 2 of the Cols division. He returned to Milford Center on February 6, 1919, and served as track foreman at that point until June, 1923, when he was advanced to supervisor of track, with headquarters at Richmond.

William Bruce Ferguson, whose promotion to roadmaster on the Atchison, Topeka & Santa Fe at Arkansas City, Kan., was announced in the January issue, was borne at Williamsburg, Iowa, on January 21, 1891, and entered railway service in

1908, as a track laborer on the Chicago & North Western in Iowa, later being promoted to section foreman. On March 1, 1910, he went with the Santa Fe as a section foreman and extra gang foreman on the Oklahoma division. From August 20, 1917, to February 1, 1918, he served as a brakeman on the Chicago, Rock Island & Pacific at Silvis, Ill., returning to the Santa Fe on February 15, 1918, as a section foreman at Arkansas City, Kan., and served in this capacity and as extra gang and yard foreman until his recent promotion.

Andrew N. Ferguson, whose retirement as roadmaster on the Atchison, Topeka & Santa Fe at Arkansas City, Kan., was announced in the January issue, was born at Williamsburg, Iowa, on October 17, 1888, and entered railway service on July 5, 1900, as a water boy on the I. & M. division of the Chicago & North Western. In 1901, he became a section laborer at Buxton, Iowa, later being promoted to relief foreman. From 1904 to 1910, he worked as a section foreman and car repairer and in 1910, he went with the Santa Fe as section foreman and extra gang foreman on the Oklahoma division. In 1923, Mr. Ferguson was promoted to roadmaster on the Southern Kansas division. In 1931, he was transferred to the Middle division and in 1937, to the Oklahoma division with headquarters at Arkansas City, Kan.

William Henry Lundy, whose promotion to roadmaster on the Southern Pacific, with headquarters at Sparks, Nev., was announced in the December issue, was born at Ogden, Utah, on July 21, 1887, and entered railway service on December 20, 1909, as a rodman on the Southern Pacific, later being promoted to instrumentman. In 1913, he was promoted to office engineer and during the war he served with the U. S. Army. He then served for a time as assistant engineer of the Utah-Idaho Central, with headquarters at Ogden, Utah, and in 1920 returned to the Southern Pacific as a bridge inspector. In 1923, Mr. Lundy was appointed office engineer and in 1931, he was advanced to assistant engineer, the position he held at the time of his recent appointment.

M. A. Haessly, assistant roadmaster on the Chicago & North Western at Milwaukee, Wis., has been promoted to roadmaster of subdivision No. 1 of the Sioux City division, with headquarters at Wall Lake, Iowa, succeeding **M. J. Bielema**, who has been transferred to subdivision No. 2 of the Sioux City division, with the same headquarters. Mr. Bielema replaces **F. C. Hajek**, who has been transferred to Belle Plaine, Iowa, relieving **E. A. White**, who has been transferred to Harvard, Ill., succeeding **M. Carroll**. Mr. Carroll has been transferred to Chicago, relieving **J. D. Sullivan**, who has been transferred to Mayfair, Ill., relieving **D. V. O'Connell**. Mr. O'Connell has been transferred to Chicago, replacing **William L. Campbell**, whose death on January 2, was announced in the January issue.

J. C. Teague, section foreman on the Louisville & Nashville at Springfield, Tenn., has been promoted to track super-

visor on the Evansville division, with headquarters at Irvington, Ky., relieving **C. N. Petty**, who has been transferred to Madisonville, Ky. Mr. Petty succeeds **Thomas Hammond**, who has retired. **O. E. Butler** has been appointed track supervisor at Cullman, Ala., replacing **W. F. Higgins**, who has retired. **N. B. Tyler**, instrumentman on the Cincinnati division at Latonia, Ky., has been promoted to track supervisor on the Eastern Kentucky division at Frankfort, Ky., succeeding **W. C. Mahoney**, who retired because of ill health on January 1. **M. L. Perkins**, section foreman at Upton, Ky., has been promoted to track supervisor, with headquarters at Memphis, Tenn., replacing **P. H. Fitzsimmons**, who retired on February 1.

Bridge and Building

H. H. Alfrey, chief scale inspector of the Chicago, Rock Island & Pacific, has been appointed also supervisor of painting for the system, with headquarters as before at Chicago.

W. R. Burke, general foreman of bridges and buildings on the Illinois Central at Champaign, Ill., has been promoted to supervisor of bridges and buildings, with the same headquarters, succeeding **J. H. Morgan**, who retired on January 1.

Foster R. Spofford, assistant supervisor of bridges and buildings on the Terminal division of the Boston & Maine at Boston, Mass., has been promoted to supervisor of bridges and buildings of the same division to succeed **Forrest C. Brackett**, whose death on December 1, was announced in the January issue. **John A. Kerig**, a member of the engineering corps of the Terminal division, has been promoted to assistant supervisor of bridges and buildings to succeed Mr. Spofford. These appointments become effective on January 1.

Mr. Spofford was born on March 26, 1906, at Phillipsburg, N.J., and attended the engineering school at Tufts college, graduating in civil and structural engineering in 1927. From July, 1928, to March, 1929, he served as an inspector on sewer construction with the consulting engineering firm of Metcalf & Eddy, then going with the firm of Jackson & Moreland to serve as a designing draftsman on the electrification of the Delaware, Lackawanna & Western. He entered the service of the Boston & Maine on October 15, 1929, as a structural draftsman at Boston. On December 1, 1937, he was promoted to assistant supervisor of bridges and buildings, which position he held until his recent promotion as supervisor of bridges and buildings.

Obituary

C. J. McNamara, track supervisor on the Erie at Jersey City, N.J., died suddenly on January 4.

Thomas O'Hara, who retired in 1928 as bridge and building master on the Canadian Pacific after serving for 40 years in this capacity, died on December 26, 1939, at his home at London, Ont.

A. E. Muschott, who retired on September 16, 1939, as roadmaster on the Elgin,

Joliet & Eastern, with headquarters at Joliet, Ill., died at Joliet on January 15, following an operation for stomach ulcers. A sketch of Mr. Muschott's career was published in the November, 1939, issue, following his retirement last fall.

William L. Campbell, roadmaster on the Chicago & North Western at Chicago, whose death on January 2 was announced in the January issue, was born at Pecatonica, Ill., on November 26, 1870, and entered railway service on the North Western on August 1, 1893. He was promoted to section foreman on April 6, 1897, and on July 1, 1907, he was advanced to assistant roadmaster at Sterling, Ill. Four months later, Mr. Campbell was promoted to roadmaster at Ashland, Wis., and on October 12, 1910, he was transferred to Madison, Wis. He was transferred to Chicago on December 25, 1911, and remained at that point until his death.

Max H. Wickhorst, former engineer of tests of the Chicago, Burlington & Quincy, with headquarters at Aurora, Ill., and from February, 1910, to June, 1922, engineer of tests for the Rail committee of the American Railway Engineering Association, with headquarters at Chicago, died at Oak Park, Ill., on January 2. Mr. Wickhorst was born in Chicago on August 23, 1873, and graduated from the Northwestern University School of Pharmacy in 1891. He entered railway service in 1892 as an assistant chemist on the Burlington and in July, 1894, he became a locomotive fireman. From January 1, to July 1, 1895, he served as an instructor of analytical chemistry at Northwestern University, returning to the Burlington on the latter date as assistant chemist, being promoted to engineer of tests, with headquarters at Aurora in April, 1897. In February, 1910, Mr. Wickhorst left the Burlington to become engineer of tests for the Rail Committee of the American Railway Engineering Association, holding that position until June, 1922, when he resigned to engage in private business.

William C. Cushing, who retired in 1932 as engineer of standards of the Pennsylvania, died on January 12, at his home at Germantown, Pa., at the age of 77 years. Mr. Cushing was born on March 18, 1863, at St. John, N.B., and was educated at the University of New Brunswick and at Massachusetts Institute of Technology. He first entered railway service in 1887, as a rodman on the engineering corps of the Jeffersonville, Madison & Indianapolis (now part of the Pennsylvania). Two years later he became engineer maintenance of way on the Cincinnati & Muskingum Valley (now also part of the Pennsylvania), being appointed division engineer on the Pennsylvania in 1890. In January, 1901, he was promoted to superintendent, serving successively in this capacity on the Panhandle and Eastern divisions. In 1903, he was promoted to chief engineer maintenance of way of the Southwest System, which position he held until 1918, when he took over the same position on the Lines West of Pittsburgh. His appointment as engineer of standards came in 1920. In this position, which he held at the time of his retirement, he was attached to the staff of the chief engineer,

with jurisdiction over the standardization of practices and methods in the maintenance of track and roadway structures. Mr. Cushing was a charter member of the



William C. Cushing

American Railway Engineering Association and for many years was active in the affairs of this association, serving as president in 1911-12.

Parker C. Newbegin, chief engineer of the Bangor & Aroostock, with headquarters at Houlton, Me., died on January 22 at the age of 70 years. Mr. Newbegin was born on May 19, 1869, at Defiance, Ohio, and was educated at Bowdoin college and at the Massachusetts Institute of Technology, graduating from the latter in 1894. In the same year he entered the service of the Bangor & Aroostock as a rodman, serving in this capacity and as a draftsman and assistant engineer until 1896. From that year until 1900, he served as chief engineer and superintendent on the construction and operation of the Patten and Sherman (now part of the B. & A.).



Parker C. Newbegin

From January to July, 1901, he was engaged on location work for the Portland & Rumford Falls (part of the Maine Central) and the Maine Central. At the end of this period he returned to the B. & A. as an assistant engineer, serving in this capacity until 1907 when he was advanced to maintenance engineer. In 1928, Mr. Newbegin was further promoted to chief engineer of the road, which position he continued to hold until his death.

Association News

American Railway Bridge and Building Association

The Executive Committee met in Chicago on January 13 to complete the selection of committees. The recommendation of the Committee on Hotel Facilities that the Hotel Stevens be selected for the next convention was approved, and the committee was instructed to complete negotiations. Seventeen new members were elected.

National Railway Appliances Association

Since the publication of the January issue of *Railway Engineering and Maintenance*, which included a list of 67 manufacturers who had already arranged to exhibit at the twenty-ninth annual exhibition of the association to be held at the International Amphitheatre, Chicago, on March 11-14, coincident with the convention of the American Railway Engineering Association, the following eight additional companies have arranged to exhibit their equipment and materials.

Chicago Pneumatic Tool Company, New York.

Dimick-Mosher Products Company, Boston, Mass.

Hayes Track Appliance Company, Richmond, Ind.

Hogan, George M., Chicago.

Jacobsen Manufacturing Company, Racine, Wis.

Moto-Mower Company, The, Chicago.

Nichols, Geo. P. & Bros. Inc., Chicago.

Northwestern Motor Company, Eau Claire, Wis.

Maintenance of Way Club of Chicago

The January meeting of the club, held at the Auditorium Hotel on January 22, was addressed by three speakers in a symposium on "Rail Joint and Rail End Maintenance." The speakers were C. W. Baldrige, assistant engineer, Atchison, Topeka & Santa Fe, Chicago, who discussed The Essential Elements of Rail Joint Design; A. W. Chaney, district engineer, Missouri Pacific, Little Rock, Ark., who discussed The Reconditioning of Rail Joints and Rail Ends by Welding and Other Means; and J. B. Martin, general inspector track, New York Central, Cleveland, Ohio, who discussed The Trackman's Responsibility for the Maintenance of Rail Joints and the Protection of Rail Ends. One hundred and ten members and guests were in attendance. The next meeting will be held at the Auditorium Hotel on February 26, at 6:30 p.m.

Metropolitan Maintenance of Way Club

With 65 members and guests in attendance, the club held its December meeting on the eighth in conjunction with the annual dinner of the New York Railroad Club. The speaker was Dr. Herman von Schrenk, consulting timber engineer, who addressed the club informally on the sub-

ject of Timber Preservation. After a brief review of the history of timber preservation, Dr. von Schrenk discussed different aspects of the subject that are currently receiving attention. He described the character and extent of the marine-borer infestation now under way along the North Atlantic seaboard, and outlined various measures that are being taken to protect timber water-front structures against these organisms. He also described at considerable length experiments with galvanized spikes and other track fastenings, that are being carried out on various roads to determine their resistance to corrosion.

The next meeting of the club will be held on February 29, at the Governor Clinton hotel, New York, with dinner at 6:30. It is not planned to have a formal speaker at this meeting but to throw open for general discussion a subject of interest to all members of the club.

Wood-Preservers' Association

Approximately 375 men interested in timber treatment and its use attended the thirty-sixth annual convention of the association at St. Louis, Mo., on January 23-25. In addition to numerous reports on the technic of timber preservation and on the service records of treated timber, addresses were presented by G. W. Harris, chief engineer, A. T. & S. F. System, on What We Can Expect from Treated Ties; by G. H. Trout, bridge engineer, U. P. System, on The Preframing of Timber for Use in Bridges; by G. R. Smiley, chief engineer, L. & N., on The Stacking, Seasoning and Treatment of Gum Lumber for Railroads; and by Elmer T. Howson, editor, *Railway Engineering and Maintenance*, on Further Diversified Uses of Treated Wood by the Railroads. Mr. Harris' address appears elsewhere in this issue. Mr. Trout's paper will appear in an early issue.

At the closing session, Ralph E. Meyers, vice-president and sales manager, International Creosoting & Construction Company, was elected president; W. R. Goodwin, engineer wood preservation, Minneapolis, St. Paul & Sault Ste. Marie, was elected first vice-president; W. P. Conyers, vice-president and treasurer, Taylor-Colquitt Company, was elected second vice-president; and H. L. Dawson was re-elected treasurer. Louisville, Ky., was selected as the headquarters for the next convention.

American Railway Engineering Association

Preliminary arrangements have been completed for the convention to be held at the Palmer House, in Chicago, on March 12, 13 and 14. With the mailing of Bulletin No. 415 early in January, members of the association now have pre-prints of all of the committee reports to be presented at the convention with the exception of seven, which will be sent out in Bulletin No. 416 about the middle of February. This last bulletin will contain reports of the Committees on Wood Preservation, Roadway and Ballast, Track, Rail, Complete Roadway and Track Structure, Ties, and Stresses in Track. Early in February,

also, ballots for the election of officers, directors and members of the nominating committee for the ensuing year will be sent to all voting members.

With the committee work for the current year practically completed, only one committee held a meeting in January, this being the Committee on Yards and Terminals, which met at Cleveland, Ohio, on the 15th, and only two committees have scheduled meetings for February, these being the Committee on Iron and Steel Structures, which will meet in Chicago on February 8 and 9, and the Committee on Economics of Railway Location and Operation, in St. Louis, Mo., on the same days.

Roadmasters Association

G. L. Sitton (Southern), president, has announced the following personnel of committees to study and present reports at the convention next September:

Ditching and Bank Widening—Methods and Equipment Best Suited for this Work—C. Halverson (chairman), div. rdm., G.N., Grand Forks, N.D.; A. B. Chaney (vice-chairman), dist. engr., M.P., Little Rock, Ark.; J. F. Barron, rdm., Sou., Selma, Ala.; A. J. Butler, supvr. I.C., Gilman, Ill.; H. H. Britton, rdm., N.Y.C., Albion, Mich.; C. M. Burpee, managing editor, *Railway Engineering and Maintenance* Cyclopedic, Chicago; C. F. Edwards, supvr., C. & O., Columbus, Ohio; M. E. Flowers, supvr., C.R.I. & P., Booneville, Ark.; G. J. Giles, supvr., L. & N., Harlan, Ky.; Omer Gosselin, rdm., C.P., Aroostook Jct., N.B.; A. E. Hendricks, supvr., Sou., So. Clarksville, Va.; W. C. Johnson, stdt. appr., Sou., Cincinnati, Ohio; V. I. Kessinger, rdm., A.T. & S.F., Independence, Kan.; R. H. Millikin, rdm., C. P., Trenton, Ont.; J. M. Murphy, rdm., C.M. St.P. & P., Sioux Falls, S.D.; Wm. O'Brien, rdm., P.M., Toledo, Ohio; R. T. Osborne, supvr., N.S., Star, N.C.; S. Payson, rdm., St.L.-S.F., Enid, Okla.; G. K. Sterling, rdm., C. & N.W., Eagle Grove, Ia.; A. W. Wehner, rdm., S.P., Lake Charles, La.; T. L. Williamson, rdm., S.P., Winnemucca, Nev.

Handling Snow and Ice in Terminals and on the Line—Organization, Equipment and Methods—P. Chicoine (chairman), rdm., C.P., Vaudreuil, Que.; Guy Palmer (vice-chairman), engr. main., B. & O. C.T., Chicago; W. Allan, rdm., C.P., Montreal, Que.; Marcel Belec, gen'l. for., C.P., Montreal, Que.; G. R. Chambers, devel. dept., C.I. Ltd., Montreal, Que.; L. J. Gilmore, rdm., G.N., Superior, Wis.; J. R. Hamilton, div. engr., D.S.S. & A., Marquette, Mich.; W. E. Heimerdinger, dist. engr. maint., C.R.I. & P., Des Moines, Ia.; R. S. Kniffen, gen'l. rdm., G.N., Duluth, Minn.; F. J. Liston, rdm., C.P., Montreal, Que.; R. W. Lucas, rdm., C.R.I. & P., Manley, Ia.; F. H. Masters, ch. engr., E.J. & E., Joliet, Ill.; P. F. Muller, rdm., C. & W.I., Chicago; H. H. Nottley, rdm., S.P., Colfax, Cal.; W. C. Peters, rdm., A.T. & S.F., Newton, Kan.; W. J. Schram, supvr., D. & H., Saratoga, N.Y.; G. G. Smart, gen'l. rdm., G.N., Seattle, Wash.; J. C. Stotler, rdm., N.P., Lester, Wash.; W. F. Wiggins, rdm., B. & A., Houlton, Me.

Effect of Weight of Rail on Track Maintenance—I. H. Schram (chairman), engr. m.w., Erie, Jersey City, N.J.; C. W.

Baldrige (vice-chairman), asst. engr., A.T. & S.F., Chicago; F. G. Campbell, asst. ch. engr., E.J. & E., Joliet, Ill.; Armstrong Chinn, ch. engr., Alton, Chicago; John Clark, supvr., B. & O., Walkerton, Ind.; N. V. Fehn, supvr., L. & N., Russellville, Ky.; W. Goodwin, III, supvr., Sou., Winston-Salem, N.C.; R. W. Grigg, supvr., Penna., New Brunswick, N.J.; W. H. Hagerty, supvr., N.Y. N.H. & H., New Rochelle, N.Y.; J. B. Kelly, gen'l. rdm., Soo Line, Stevens Point, Wis.; G. S. King, supvr., Sou., Blackville, S.C.; W. F. Monahan, gen'l. trk. insp., S.P., San Francisco, Cal.; G. M. O'Rourke, dist. engr., I.C., Chicago; C. W. Russell, rdm., Sou., Greenville, S.C.; H. W. Steger, gen'l. for., Jacksonville Term., Jacksonville, Fla.; I. D. Talmadge, rdm., N.Y.O. & W., Oneida, N.Y.; John Vreeland, assoc. editor, *Railway Engineering and Maintenance*, Chicago; G. E. Yahn, dist. engr. m.w., C.B. & Q., Burlington, Ia.

Welding—Its Uses in Track Work—R. L. Fox (chairman), rdm., Sou., Alexandria, Va.; G. L. Griggs (vice-chairman), rdm., C.B. & Q., Hannibal, Mo.; W. B. Bailes, supvr., Sou., Charlottesville, Va.; R. H. Carter, div. engr., I.C., Chicago; J. J. Clutz, supvr., Penna., Trenton, N.J.; E. C. Buhner, supvr., N.Y.C., Sandusky, Ohio; L. M. Denney, supvr., C.C.C. & St.L., Indianapolis, Ind.; H. C. Fox, supvr., Sou., Spartanburg, S.C.; R. H. Gilkey, div. engr., C. of Ga., Savannah, Ga.; W. A. Gunderson, dist. main. engr., C.R.I. & P., Kansas City, Mo.; J. C. Jacobs, supvr., I.C., Decatur, Ill.; C. E. Morgan, supt. work equip., C.M. St. P. & P., Chicago; J. Morgan, ret. supvr., C. of Ga., Leeds, Ala.; W. P. Nichols, supvr., C. & O., Riverton, Ky.; D. V. O'Connell, rdm., C. & N.W., Chicago; W. H. Oglesby, supvr., Sou., Camden, S.C.; C. R. Schoenfeld, rdm., C.B. & Q., Aurora, Ill.; J. O. Surprenant, rdm., D. & H., Schenectady, N.Y.

The Maintenance of Gage—Its Importance Under Today's Higher Speeds—Causes and Effects of Irregular Gage—Means of Correcting—M. W. Rector (chairman), dist. main. engr., C.R.I. & P., El Reno, Okla.; P. L. Koehler (vice-chairman), div. engr., C. & O., Ashland, Ky.; G. W. Benson, supvr., C. of Ga., Macon, Ga.; L. C. Blanchard, rdm., C.M. St.P. & P., Spencer, Ia.; W. E. Chapman, supvr., C. of Ga., Columbus, Ga.; J. S. Davis, supvr., N.S., Edenton, N.C.; P. DiFore, gen'l. for., C.P., Montreal, Que.; J. G. Gilley, supvr., C. & O., Pikesville, Ky.; A. J. Johnson, asst. rdm., C. & N.W., Chicago; J. D. Kirkland, supvr., C. R. I. & P., Herkington, Kan.; W. E. Manning, stdt. appr., Sou., Danville, Va.; J. A. Rust, rdm., Sou., Winston-Salem, N.C.; J. C. Runyon, supvr., C. & O., Covington, Ky.; F. F. Scoggin, supvr., Sou., Greensboro, N.C.; R. B. Smith, supvr., C.R.I. & P., Wichita, Kan.; W. H. Sparks, gen'l. insp. track, C. & O., Russell, Ky.; G. A. Stevens, supvr., L. & N., Richmond, Ky.; G. E. Stewart, rdm., S.P., Merced, Cal.; J. R. Vaughan, supt., Utah, Helper, Utah; R. A. Williams, rdm., C.B. & Q., Wymore, Neb.

Slow Orders—Their Use in the Light of Present-Day Operating Conditions—E. J. Banion (chairman), rdm., A.T. & S.F., Marceline, Mo.; E. J. Brown (vice-chairman), dist. engr. m.w., C.B. & Q., Galesburg, Ill.; M. R. Black, supvr., L. & N.,

Etowah, Tenn.; E. G. Brisbin, supvr., M.C., Jackson, Mich.; J. F. Beaver, supvr., Sou., Durham, N.C.; M. H. Dick, eastern editor, *Railway Engineering and Maintenance*, New York, N.Y.; H. E. Kirby, asst. engr., C. & O., Richmond, Va.; J. D. McSheffrey, rdm., C.P., Prescott, Ont.; R. E. Meyer, rdm., C. & N.W., Mason City, Ia.; E. M. Pelter, asst. rdm., Sou., Somerset, Ky.; E. L. Potarf, asst. supt., C.B. & Q., Sterling, Colo.; W. C. Radford, supvr., Sou., Chester, S.C.; R. L. Sims, asst. supt., C.B. & Q., Wymore, Neb.; T. N. Turner, rdm., M.P., Newport, Ark.

Supply Trade News

General

The Ardco Manufacturing Company has moved its office from 1 Newark street, Hoboken, N.J., to 137-143 Franklin street, Jersey City, N.J.

Personal

George W. Hoover has been appointed export sales manager for the Duff-Norton Manufacturing Company, Pittsburgh, Pa., with headquarters at New York.

W. B. Moore, who has been associated for 20 years with the Timken Roller Bearing Company, Canton, Ohio, in various sales activities, has been appointed director of sales of the Steel and Tube division. Mr. Moore joined the Timken organization early in 1919, following his graduation from the University of Michigan. After serving in the Canton office, he was placed in charge of the company's Pacific Coast district, and since 1933, he has been manager of industrial sales. S. C. Parttridge, assistant manager of industrial sales, succeeds Mr. Moore as manager of industrial sales.

Herbert J. Watt has been appointed manager of sales for the central area of the Carnegie-Illinois Steel Corporation. Mr. Watt will co-ordinate sales activities of Carnegie-Illinois offices at Pittsburgh, Pa., Cleveland, Ohio, Cincinnati and Detroit, Mich. His headquarters will be at the general offices in the Carnegie building, Pittsburgh. Mr. Watt entered the steel industry in the Philadelphia office of the Carnegie Steel Company in 1912 and in 1917 was transferred to the Washington office of the United States Steel Corporation Subsidiaries. He was formerly assistant general manager of sales for Jones & Laughlin Steel Corporation.

Ralph E. Meyers, sales manager of the International Creosoting & Construction Company, with headquarters at Galveston, Tex., has been elected vice-president and sales manager with the same headquarters. He was born in Cincinnati, Ohio, on July 11, 1899, and after graduating in chemical engineering from the State University of New Mexico in 1919, he served as instructor in chemistry at this college for two years. He was then employed as research chemist for the Chino Copper Company at Hurley, N.M., for a year. His first connection with the creosoting indus-

try was with the Atchison, Topeka & Santa Fe as chemist at its tie treating plant at Albuquerque, N.M. In 1922, he entered the employ of the International Creosoting & Construction Company as plant chemist at its plant at Texarkana, Tex. Three years later, he was placed in charge of all chemistry work for this company, with headquarters at Galveston, which position he occupied until his appointment as sales manager on January 1,



Ralph E. Meyers

1936. Mr. Meyers has taken an active part in the work of various technical associations. He worked in 1928-1930 with the American Standards Association Committee on the strength of pole woods, developing the present widely accepted standards for pole strength. He is now president of the American Wood-Preservers' Association.

O. M. Bernuth, who has become president of the Chipman Chemical Company, Inc., as reported in the January issue, is



O. M. Bernuth

also president of both the Bernuth, Lembcke Company, of which the Chipman Chemical Company is now a wholly-owned subsidiary, and of the Elastic Rail Spike Corporation. The business of the Chipman Chemical Company will be conducted, as heretofore from the main office at Bound Brook, N.J. Warren H. Moyer, formerly secretary and treasurer of this concern, whose appointment as vice-president and treasurer was also noted in the January issue, has been placed in charge of the railroad division, while J. A. Wil-

liams has been appointed assistant manager of this division. A. A. Murphy, formerly manager of railways sales, has resigned. Ralph N. Chipman, whose resignation because of ill health, effective January 1, as president of the Chipman Chemical Company, a company that he founded 22 years ago, was announced in the January issue, was born in Beverly, N.J., and was educated at the Penn Charter school at Philadelphia, Pa. Early in his career he became affiliated with the Atlas Preservative Company of America. In 1917, Mr. Chipman formed the Chipman Chemical Company to engage in the manufacture and marketing of chemicals for killing weeds, remaining at the head of this company until his resignation.

Trade Publications

Wood Preservation Machinery—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued a 32-page Bulletin, No. 1834, on Machinery for Wood Preservation, which touches on the history of wood preservation, the kinds of preservatives used in the treatment of wood, the methods and processes used, the economics of wood preservation and the types of machinery used. Several designs of complete plants are shown and the yard arrangement and handling methods are discussed. The bulletin is attractively illustrated with numerous photographs; tables giving weights and measures of piling, telegraph poles, cross arms and ties are also included.

Rail End Hardening—A 12-page catalog with this title has been issued by the Teleweld, Inc., Chicago, describing rail end hardening by the Teleweld process of electric induction heating. The catalog explains the development of this process and describes the apparatus used. The proper hardness and hardness pattern desirable in rail end hardening are also discussed and a page of graphs of typical hardness distribution is included. The catalog is well illustrated by numerous photographs of rail end hardening apparatus, sections of hardened rail ends showing the distribution of the hardened area and photographs showing the microstructure of the hardened zone.

Manganese Steel—An unusually complete 64-page catalog containing more than 400 illustrations, entitled AMSCO Manganese Steel, has been issued by the American Manganese Steel Division of the American Brake Shoe and Foundry Company, Chicago Heights, Ill. The subject of manganese steel is introduced with a page of questions and answers entitled, What Is Manganese Steel? The production, research facilities and various plants of the company are then described and illustrated with photographs. Immediately following are several pages explaining in detail the origin of manganese steel, its physical properties, method of manufacture, heat treating and machining, and its qualifications for industrial uses where hardness and toughness are needed. The remaining pages are devoted to many photographs of manganese steel products used in railroad, industrial and construction equipment. Also included in the catalog are a page discussing the various types of AMSCO alloy steels for high temperature and corrosion services and a page on AMSCO welding rods.

A CAR A MINUTE

Electrically

The champion of car dumpers at Sandusky piles up new records—proves its far-reaching benefits

ON July 18 the Pennsylvania's new all-electric car dumper at Sandusky began dumping coal. When navigation closed, 2,745,000 tons had been unloaded, dumped into lake cargo vessels with the speed and precision usually associated with the dispatching of streamlined passenger trains. Availability, 100 per cent!

The electric equipment supplied by General Electric is conservatively designed to operate the dumper continuously at full capacity, and is so flexibly arranged that the dumper can still handle the maximum load even though a major piece of electric equipment should fail. The

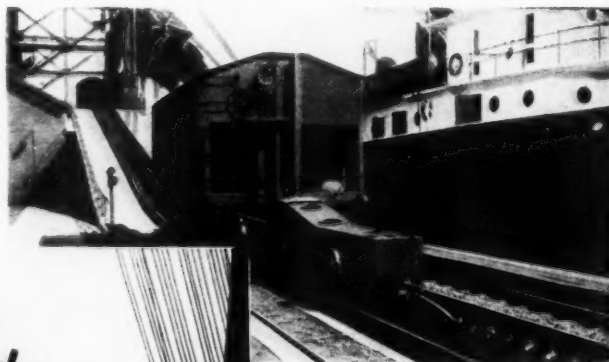
machine room is ventilated by a blower and filter arrangement; fresh, clean air is supplied 24 times. The dumper is equipped with floodlights for night operation.

This project included the dredging of a new 400-foot channel nearly a mile long, and a new coal dock. Lake carriers can now enter, load, and leave in an almost unbelievably short space of time. Cars are unloaded so promptly that yard congestion is avoided; rolling stock can be returned to revenue service more quickly.

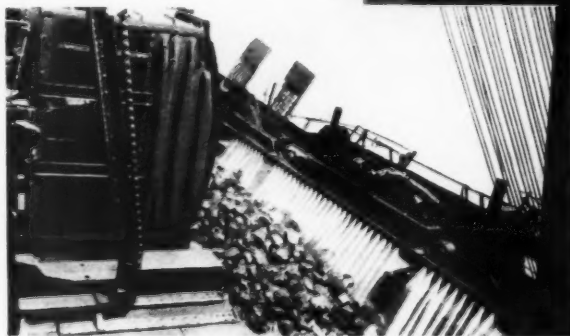
This installation, which reaches a new high in car dumper capacity—and typical of recent Pennsylvania improvements—is a fine example of projects to which General Electric can contribute much, in both good engineering and the right electric equipment.

IN projects representing large capital expenditures—such as car dumpers, ore unloaders, and lift bridges where reliability is of major importance—dependable operation must be certain. Responsibility for the design and co-ordination of the electric equipment should rest upon an organization qualified by long training and years of experience. Only in this way is your investment adequately protected and the maximum operating and maintenance economy obtained. They're really electrification jobs and General Electric can be of service to you.

In the less spectacular applications of electric equipment—such as floodlighting of yards, keeping switches free of snow, providing battery charging for cars, operation of coaling stations and water pumping plants, and the many applications of welding, heat-treating, and machine-tool drive—electric energy will either speed up operations or show an attractive saving. Put these electrical problems also up to the nearest G-E office.



The Barney, having just come up out of the pit, is starting a car up the ramp



The flow of coal being retarded in the pan while the water sprinkler is in operation

G E N E R A L



A FEW RECORDS:

95 cars in 99 minutes (60-ton and 80-ton cars)

9938.2 tons in 2½ hours (2 hours and 40 minutes between arrival and departure of vessel)

One vessel refueled and loaded with 12,400 tons of coal in 4 hours and 5 minutes (elapsed time between arrival and departure)

E L E C T R I C

96-592

ECONOMICAL FLEXIBILITY



BURRO FLEXIBILITY permits using the Crane under practically any conditions. When working under traffic, fast travel speed over 20 miles an hour, facilitates clearing for trains, or if desired, the Crane can be set off the track. Low overall height permits using the Crane mounted on a car in a work train.



WIDE OPERATING RANGE . . . keeps the Burro busy throughout the year. Rail relaying, track building or dismantling, ditch cleaning, scrap handling, bridge repairing, rail loading or unloading, pile driving, coal handling, are some of the Crane's many jobs.

Top Illustration shows scrap handling with magnet, and Crane is mounted on flat car. Lower view shows Crane building new track, hauling its own cars of rail, etc.

BURRO CRANES

Model 15 Model 30

BURRO ANTI-SLIP RAIL TONGS

Write for Bulletin

CULLEN-FRIESTEDT COMPANY

1301 So. Kilbourn Ave.

Chicago, Illinois

NOW Electric Tie Tampers ***SYNTRON***

Comparable in weight and ease of handling to Air Tampers

The New 1940 Syntron "Heavy Blow" Tamper is not only 20 lbs. lighter in weight—but is more powerful than ever.



Power and light weight in a Tie Tamper for the first time.

For Out of Face Work

Ease of handling and the "Heavy Blow" tamping speed will cut direct labor costs from 20% to 30% per mile under present standards.

Gas-Electric Plants

New, smaller, more compact portable engine-generator sets in the following capacities.

2 Tool—4 Tool—6 Tool—8 Tool
12 Tool and 16 Tool Sets on Wheels

Write for Detailed Information

SYNTRON CO.

Homer City, Pa.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
"SUPERECTOR"

A big wrench for the big jobs

Here's a powerful Reversible Ratchet Wrench that's made to handle the big, tough jobs with ease and safety. Its *Quadruple Pawls* provide approximately double the strength of usual designs; its *drop-forged* handle utilizes this added strength without increased bulk and weight.

Ask your distributor about this amazing wrench, or write for descriptive literature.



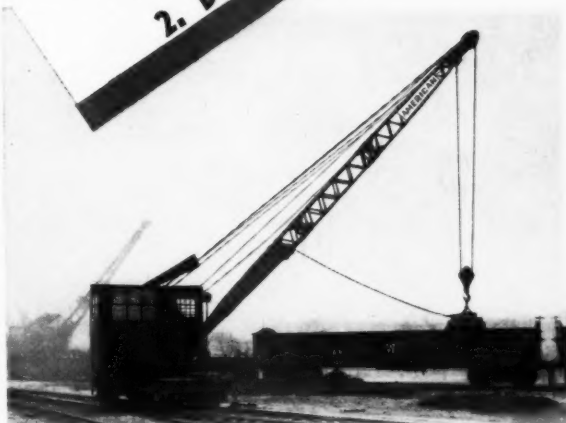
● Williams' "Superector" is made in 5 sizes—24 to 53". It handles both Hex and Square Sockets with 1 to 4-5/8" openings. Socket hole extends clear thru so nuts may be turned all the way down on any length bolt.

J. H. WILLIAMS & CO., 225 Lafayette St., NEW YORK



Railway Engineering and Maintenance

Swingline
1. PERFORMANCE
2. DURABILITY



The AMERICAN EAGLE CRANE

is famous for sensational performance and phenomenal ruggedness. Here are two samples: 1—at Roanoke, Virginia, an AMERICAN EAGLE Crane, owned by the Norfolk & Western R. R. and equipped with a magnet, loaded 10,000 tie plates, total weight about 6000 pounds, and switched the car out in an hour and 10 minutes; 2—This same machine was put into service in November, 1936, and up to last fall the valve cover had never even been off the motor for checking. All last summer this machine worked 70 hours a week and still is in excellent shape. Recently, digging in hard clay, it heaped a 16-yard car in 30 minutes.

You could use performance like that, so why not write today for catalog No. 600-L-3 and get all the facts?

AMERICAN HOIST & DERRICK CO.

NEW YORK

SAINT PAUL, MINNESOTA

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AMERICAN TERRY DERRICK CO.
SOUTH KENNY, W. V.

SEE YOU AT THE N. R. A. A. EXHIBITION



DEALERS WITH STOCK IN ALL PRINCIPAL CITIES

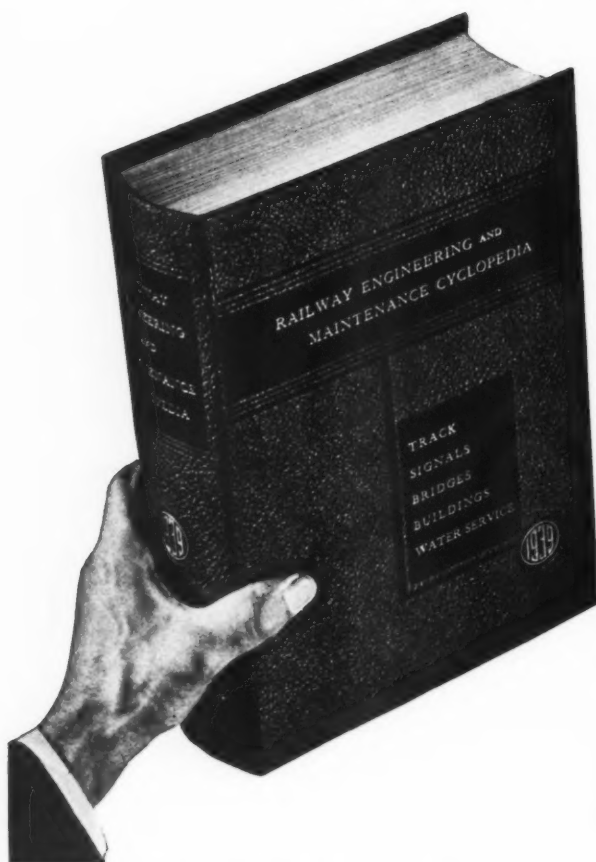
the Genuine **CROSBY** wire rope **CLIP**

PERFECT GRIP SHOCK FORGED
STEEL NOT GALVANIZED

February, 1940

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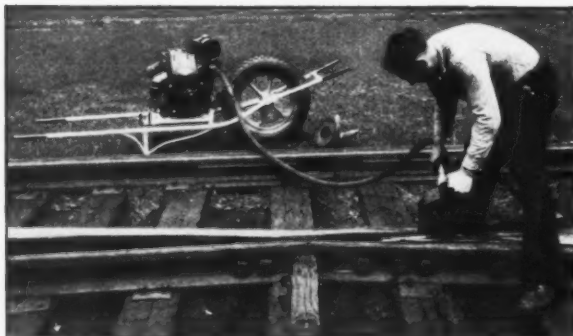
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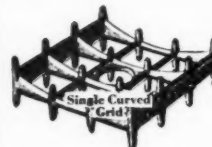
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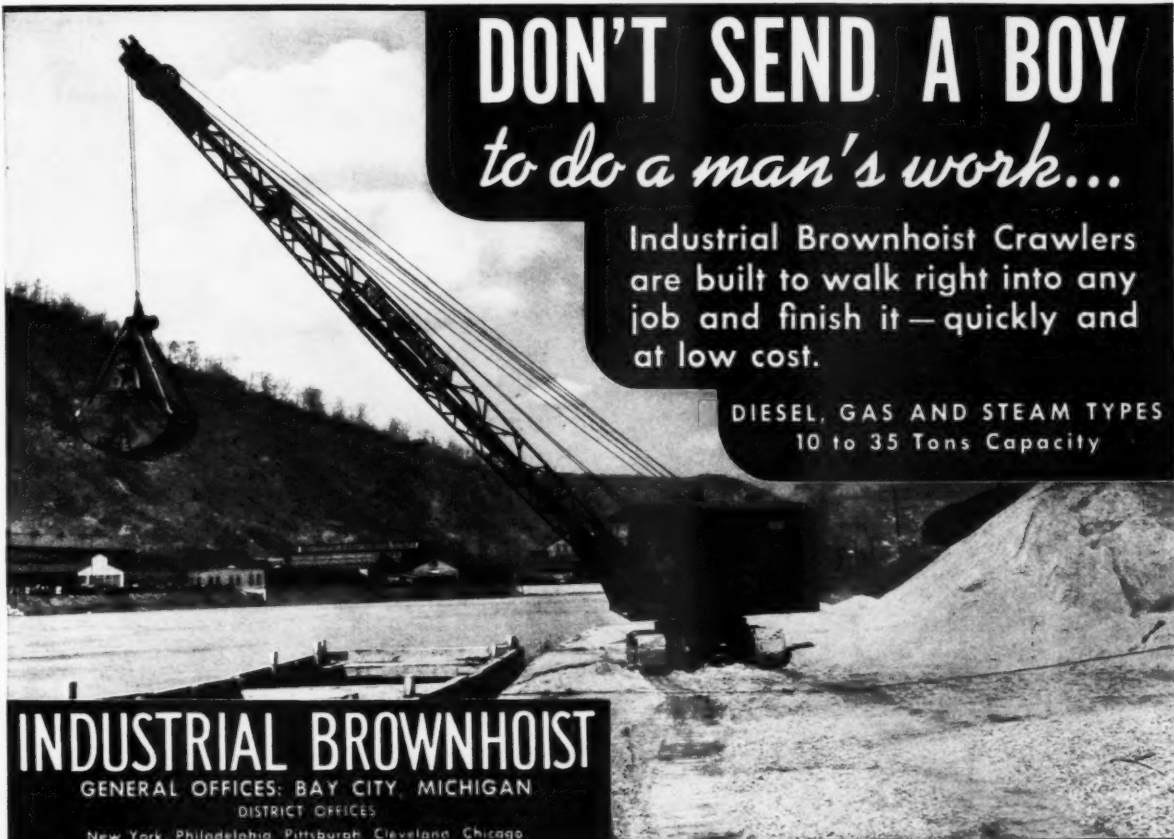
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